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IV

HETEROMI, SOLENICHTHYES, SYNENTOGNATHI, PERCESOCES, LABYRINTHICI, MICROCYPRINI

with 103 illustrations

BY

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Professor at the University of Amsterdam

AND

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INTRODUCTION.

The present volume is the fourth of the series of volumes devoted to the knowledge of the fishes of the indo-australian Archipelago and the third in which we endeavour to give a concise description of all the fishes at present known to inhabit the seas and freshwater of that Archipelago and also to show their distribution through this area. We have already defined the character and geographical limits of this area in the Introduction to the second volume.

In the present volume the orders of *Heteromi*, *Solenichthyes*, *Synentognathi*, *Percesoces*, *Labyrinthici* and *Microcyprini* are treated.

The material at our disposal has already been mentioned in the Introduction to the former volumes, so that we have only to add the following new additions.

In acknowledging our obligations to contributors of valuable material, we have to mention the following collections:

From Sumatra a collection made by Jonkheer F. C. VAN HEURN at Deli.

From New Guinea an extensive collection made by Jonkheer W. C. VAN HEURN in the Mamberamo-river and its tributaries.

In former volumes we had the opportunity to thank Dr. J. C. KONINGSBERGER for his interest and collaboration in the present work which was published with his aid.

Dr. W. M. DOCTERS VAN LEEUWEN, his successor as Director of 's Lands Plantentuin at Buitenzorg, Java, has shown the

same interest. We are under particular obligations to him and to Dr. A. L. J. SUNIER, Head of the Government Laboratory for Marine Investigation at Batavia and to Dr. K. W. DAMMERMAN, Director of the Zoological Museum at Buitenzorg, for sending us for study the fishes in the institutions under their control.

We are also indebted to Mr. B. A. BEAN (Washington), A. R. MC CULLOCH (Sydney), Dr. G. DUNCKER (Hamburg), H. W. FOWLER (Philadelphia), Dr. J. PELLEGRIN (Paris), Dr. F. SARASIN and Dr. J. ROUX (Basel) for valuable informations concerning species in the collections under their charge.

Again we have to thank Prof. Dr. E. D. VAN OORT and Miss Dr. C. POPTA for giving us every facility to study the fishes in the Leiden Museum, especially the specimens of BLEEKER's collection.

We beg to express our hearty thanks to Mr. C. TATE REGAN for his kind help in studying some fishes in the British Museum during the preparation of this volume. Also to Dr. V. PIETSCHMANN when comparing some types in the Vienna Museum.

For the benefit of those who make use of this volume we repeat the technical informations, given in the Introduction to the former volumes of this series.

"In describing the fishes we understand by *Length*, in the discussions of the proportions, the distance between the snout and the base of the caudal fin; in giving the largest size known for a species, we include the caudal fin.

The *Head* is measured from the tip of the snout to the end of the opercle, its proportion to the length is indicated e.g. as follows: head $4—4^1/_2$ means, that the length of the head is contained 4 to $4^1/_2$ times in the length.

Height is the maximum height; in special cases it is indicated how it is measured; the figures placed behind "height" indicate how many times it is contained in the length.

The size of the *Eye*, the length of the *Snout*, of the *Jaws* etc. are compared with the length of the head; thus "eye 4" means, that its diameter is $^1/_4$ of the length of the head.

In counting the *Scales*, under "*L.l.*" is given the number of scales, with or without sensory organs, between the head

and the caudal fin or, in most cases, between that fin and the upper corner of the opercle.

L.t. $\frac{3\frac{1}{2}}{6\ (7)}$ signifies, that there are $3^1/_2$ rows of scales between the dorsal fin and the lateral line and 6 to 7 below it, the lateral line itself is in this case not counted. In other cases the lateral line itself is also counted f.i. *L.t.* $\frac{4\frac{1}{2}}{1\ \ 1}$ (between D. and V.), which signifies, that there are $4^1/_2$ rows of scales between the dorsal fin and the lateral line, one in the lateral line itself and one between it and the ventral fin.

In the *Fin formulae* the spines and the simple, non-branched rays are generally indicated by a figure, separated by a point from that of the number of the branched rays.

The last soft ray of the dorsal and anal, in case it is cleft to the base and therefore counted as two by some authors (BLEEKER e. g.), is reckoned as one, being supported by a single pterygophore.

The *Gillmembranes* may be totally free from each other and from the isthmus; they may be united, but still remain free from the isthmus; or they may be connected with the isthmus and with each other. When in the last case the posterior border of the united gillmembranes is not quite adnate to the isthmus, there remains a free posterior margin, running as a fold over the isthmus from one gillopening to the other.

We follow the law of priority and use the oldest name which can with certainty be made out by the description, belonging to a certain species. Its author is quoted as the author of the species and his paper is quoted in the first place, when there is no stringent reason to do otherwise.

Mention is further made of all synonyms; besides, we have quoted those papers, which contain a description of the species. If it is a widely spread one, only those papers are quoted, which contain a description of or give some informations — others than those regarding locality only — about Indo-Australian specimens of that species.

According to the international rules of nomenclature we have neglected the generic names, as e.g. those of SWAINSON, which are not accompanied by a description.

We have recorded under: "nomina indigena" those native names, which seemed to us to be trustworthy. We are of

opinion that no great value ought to be attached to them, as the unavoidable series of difficulties is still enlarged by the fact, that the authorities for those names have mostly been European ichthyologists and no linguists."

Finally there remains for us the pleasing duty of expressing our sincere thanks to Mr. J. F. OBBES, to whom we are indebted for most of the figures, which illustrate this volume and to Mr. C. PELTENBURG, head of the firme E. J. BRILL Ltd of Leiden for his interest in publishing this volume.

Eerbeek / Amersfoort, May 1922.

MAX WEBER.
L. F. DE BEAUFORT.

SYSTEMATIC INDEX

page

Order HETEROMI Gill (Boulenger emend.) 1

1. Fam. HALOSAURIDAE . . . 1
1. *Halosaurus* Johnson . . 2
1. carinicauda (Alc.) . . 2
2. *Halosauropsis* Collett . . 4
1. mediorostris (Gthr.) . . 4
2. affinis (Gthr.) 5

Order SOLENICHTHYES Regan 7

1. Fam. AULOSTOMATIDAE . . 8
1. Subfam. Aulostomatinae 9
1. *Aulostoma* Lacépède . . 10
1. valentini (Blkr.) . . . 10
2. Subfam. Fistulariinae . 11
1. *Fistularia* Linné . . . 12
1. villosa Klunz. 12
2. petimba Lacép. . . . 14

2. Fam. MACRORHAMPHOSIDAE . 15
1. *Macrorhamphosus* Lacépède 16
1. velitaris (Pallas) . . . 16

3. Fam. CENTRISCIDAE . . . 18
1. *Aeoliscus* Jordan & Starks. 20
1. strigatus (Gthr.) . . . 20
2. *Centriscus* Linné . . . 21
1. scutatus L. 22
2. cristatus (De Vis) . . 23

4. Fam. SOLENOSTOMIDAE . . 24
1. *Solenostomus* Lacépède . 25
1. cyanopterus Blkr. . . 26
2. paradoxus (Pall.). . . 27
3. armatus M. Web. . . 28

page

5. Fam. SYNGNATHIDAE . . . 30
1. *Syngnathoides* Bleeker. . 39
1. biaculeatus (Bl.) . . . 40
2. *Acanthognathus* Duncker. 41
1. dactyliophorus (Blkr.) . 42
3. *Microphis* (Kaup) Duncker 43
1. brachyurus (Blkr.) . . 44
2. manadensis (Blkr.) . . 46
3. boaja (Blkr.) 47
4. heterosoma (Blkr.) . . 48
4. *Doryichthys* (Kaup) Duncker 49
1. spinachioides Dunck. . 50
2. caudocarinatus M. Web. 51
3. brevidorsalis (de Bfrt.). 51
4. retzii (Blkr.) 52
5. deokhatoides (Blkr.). . 53
6. martensi (Ptrs.) . . . 54
Doubtful species:
1. fluviatilis (Blkr.) . . . 55
5. *Coelonotus* Peters . . . 56
1. argus (Ptrs.) 57
2. liaspis (Blkr.) 57
6. *Belonichthys* Peters. . . 59
1. fluviatilis (Ptrs.) . . . 59
7. *Choeroichthys* Kaup. . . 60
1. sculptus (Gthr.) . . . 61
2. brachysoma (Blkr.) . . 62
8. *Doryrhamphus* Kaup . . 63
1. melanopleura (Blkr.) . 64
9. *Solegnathus* Swainson . 65
1. lettiensis Blkr. . . . 66
2. güntheri Duncker . . 67
10. *Corythoichthys* Kaup (p.p.) 68
1. fasciatus (Gray). . . 70
2. crenulatus (M. Web.). 72
3. corrugatus (M. Web.). 73

page
11. *Microgнathus* Duncker . 74
1. brevirostris (Rüpp.) . 75
2. mataafae (Jord.& Seale) 77
12. *Syngnathus* Linné (Kaup) 77
1. djarong Blkr. . . . 79
2. spicifer Rüpp. . . . 80
3. argyrostictus Kp. . . 82
4. fasciolatus Dum. . . 83
5. cyanospilus Blkr. . . 83
6. uncinatus M. Web. . 84
7. punctatus M. Web. . 86
8. pelagicus L. 87
9. acus L. 88
13. *Ichthyocampus* Kaup . 90
1. carce (Ham. Buch.) . 92
2. kampeni M. Web. . . 93
14. *Nannocampus* Günther . 94
1. weberi Duncker. . . 95
15. *Penetopteryx* Lunel . . 95
1. epinnulatus (M. Web.) 96
16. *Stigmatophora* Kaup. . 97
1. argus (Rich.). . . . 97
17. *Trachyrhamphus* Kaup . 98
1. serratus (Schl.) . . . 99
18. *Yozia* Jordan & Snyder. 100
1. bicoarctata (Blkr.) . . 101
19. *Halicampus* Kaup. . . 102
1. koilomatodon (Blkr.) . 103
2. elegans (Steind.) . . 104
20. *Haliichthys* Gray . . . 105
1. taeniophorus Gray . . 106
21. *Hippocampus* Rafinesque. 106
1. abdominalis Less. . . 108
2. spinosissimus M. Web. 109
3. histrix Kp. 109
4. kuda Blkr. 110
5. trimaculatus Leach. . 112
6. coronatus Schl. . . . 113

Order SYNENTOGNATHI Gill 115

1. Suborder **Scombresocoidea** 115

page
1. Fam. BELONIDAE . . . 116
1. *Belone* Cuvier . . . 116
1. Subgenus *Eurycaulus* Ogilby 117
1. platyura Benn. . 118
2. persimilis Gthr. . 118
2. *Tylosurus* Cocco . . 119
1. strongylurus (v.Hass.) 121
2. macrolepis (Blkr.) . 122
3. kreffti (Gthr.). . . 123
4. leiurus (Blkr.) . . 124
5. incisus (C.V.). . . 125
6. annulatus (C.V.). . 126
7. melanotus (Blkr.) . 127
8. crocodilus (Lesueur) 128
9. punctulatus (Gthr.) . 129
3. *Athlennes* Jordan & Fordice. 130
1. hians C.V. . . . 131
4. *Xenentodon* Tate Regan 132
1. canciloides (Blkr.) . 133
Doubtful species:
1. cancila H.B. . . . 134

2. Suborder **Exocoetoïdea** . 134

1. Fam. HEMIRHAMPHIDAE . 135
1. *Dermogenys* van Hasselt 136
1. orientalis (M. Web.). 137
2. weberi (Blgr.). . . 138
3. ebrardti Popta . . 139
4. sumatranus (Blkr.) . 139
5. pusillus v. Hass. . 140
2. *Nomorhamphus* nov. gen. 141
1. celebensis n.sp. . . . 141
2. hageni (Popta) . . . 142
3. *Hemirhamphodon* Bleeker 142
1. phaiosoma (Blkr.) . . 143
2. pogonognathus (Blkr.). 144
4. *Hemirhamphus* Cuvier . 145
1. georgii C.V. 147
2. unifasciatus Ranz. . . 149

page
3. gaimardi C.V. . . . 150
4. melanurus C.V. . . . 151
5. balinensis Blkr. . . . 152
6. quoyi C.V. 154
7. dussumieri C.V. . . 155
8. far (Forsk.) 156
9. marginatus (Forsk.) . 157
10. convexus n. sp. . . . 159
Doubtful species:
1. russelli C.V. 161
2. erythrorhynchus Lesueur 162
3. lucens C.V. 162
5. *Zenarchopterus* Gill . . 162
1. caudovittatus (M.Web.) 164
2. ectuntio (Ham. Buch.) 165
3. rasori (Popta) . . . 166
4. novae-guinea (M. Web.) 167
5. kampeni (M. Web.). . 167
6. brevirostris (Gthr.). . 167
7. dux Seale 169
8. dispar (C.V.). . . . 169
9. buffoni (C.V.) . . . 170
6. *Arrhamphus* Günther. . 171
1. brevis (Seale) . . . 172

2. Fam. EXOCOETIDAE . . . 173
1. *Parexocoetus* Bleeker. . 173
1. brachypterus (Rich.) . 174
2. *Evolantia* Snodgrass & Heller 175
1. micropterus (C.V.). . 176
3. *Exocoetus* Linné . . . 177
1. volitans L. 177
4. *Cypsilurus* Swainson . . 179
1. oxycephalus (Blkr.) . 181
2. speculiger (C.V.) . 181
3. arcticeps (Gthr.) . . 182
4. nigricans (Benn.). . 183
5. altipennis (C.V.) . 184
6. hexazona (Blkr.) . . 185
7. bilobatus n. sp. . . . 185
8. poecilopterus (C.V.) 186
9. atrisignis Jenk. . . 187

page
10. spilopterus (C.V). . . 187
11. naresi (Gthr.). . . . 188
12. oligolepis (Blkr.) . 189
13. bahiensis (Ranz.) . 190
14. opisthopus (Blkr.) . 191
15. nigripennis (C.V.) . 192
16. brevis n.sp. 192
17. rondeleti (C.V.) . . 193

Order PERCESOCES . . . 195

1. Fam. POLYNEMIDAE . . 196
1. *Eleutheronema* Bleeker 197
1. tridactylum (Blkr.) . 198
2. tetradactylum (Shaw) 199
2. *Polynemus* Linné . . 200
1. plebejus Brouss.. . 202
2. microstoma Blkr. . 204
3. indicus Shaw . . 205
4. hexanemus C.V.. . 207
5. pfeifferi Blkr.. . . 208
6. kuru Blkr.. . . . 209
7. sextarius Bl. Schn. . 210
8. melanochir C.V.. . 211
9. heptadactylus C.V. . 212
10. longipectoralis n.sp. 213
11. borneensis Blkr. . . 214
12. dubius Blkr. . . . 215
13. macrophthalmus Blkr. 216
14. multifilis Schl. . . 217
Doubtful species:
1. paradiseus L. . . . 218

2. Fam. SPHYRAENIDAE . . 218
1. *Sphyraena* Bloch, Schneider 219
1. jello C.V. 220
2. altipinnis Ogilby . . 222
3. forsteri C.V. 223
4. picuda Bl. Schn. . . . 224
5. japonica Schlegel . . 225
6. obtusata C.V. . . . 226
7. langsar Blkr.. . . . 228
8. brachygnathus Blkr. . 229

page
3. Fam. MUGILIDAE 229
1. *Mugil* Linné 231
1. dussumieri C.V. . . 235
2. tade Forsk. 236
3. engeli Blkr. 238
4. longimanus Gthr. . . 239
5. ophuyseni Blkr. . . 240
6. speigleri Blkr. . . . 241
7. cunnesius C.V. . . . 242
8. subviridis C.V. . . . 243
9. vaigiensis Q.G. . . . 244
10. oligolepis Blkr. . . . 245
11. melinopterus C.V. . . 246
12. ceramensis Blkr. . . 247
13. troscheli Blkr. . . . 248
14. borneensis Blkr. . . 249
15. caeruleomaculatus Lac. 250
16. seheli Forsk. 252
17. cephalus L. 253
18. crenilabis Forsk. . . 256
19. macrochilus Blkr. . . 257
20. heterochilus Blkr. . . 258
21. labiosus C.V. . . . 259
2. *Cestraeus* Cuvier & Valenciennes. 260
1. plicatilis C.V. . . . 261
2. goldiei (Macl.) . . . 262
3. oxyrhynchus C.V. . . 263
3. *Myxus* Günther . . . 264
1. elongatus Gthr. . . . 264
Appendix
Agonostomus bryanti Bean & Weed. . 265

4. Fam. ATHERINIDAE . . . 266
1. *Atherina* (Artedi) Linné. 268
1. temmincki Blkr. . . 269
2. eendrachtensis Q. G. 270
3. valenciennesi Blkr. . 272
4. forskåli Rüpp. . . 274
5. duodecimalis (C.V.) Blkr. 275
2. *Craterocephalus* McCulloch. 277

page
1. nouhuysi (M. Web.). 278
3. *Telmatherina* Boulenger 278
1. celebensis Blgr. . . 279
2. bonti n.sp. 280
3. abendanoni M. Web. 281
4. *Pseudomugil* Kner . . 282
1. gertrudae M. Web. . 283
2. novae-guineae M. Web. 284
Subfam. Melanotaeniinae 286
1. *Melanotaenia* Gill . . 287
1. multisquamata n.sp. 290
2. dumasi M. Web. . 290
3. patoti (M. Web.). . 291
4. maculata M. Web. . 292
5. ogilbyi M. Web. . . 293
Doubtful species:
1. loriae (Perugia) . . 294
2. rubrostriata Rams. & Ogilby . . . 295
2. *Rhombatractus* Gill (Weber). 296
1. praecox n. sp. . . 298
2. vanheurni n.sp. . . 299
3. lorentzi M. Web. . 300
4. kochi M. Web. . . 302
5. catherinae de Bfrt. . 303
6. goldiei (Macleay) . 304
3. *Centratherina* Tate Regan 305
1. crassispinosa (M. Web.) 306
4. *Chilatherina* Tate Regan 307
1. fasciata (M. Web.) . 308
2. sentaniensis (M. Web.) 309
5. *Glossolepis* M. Weber . 309
1. incisus M. Web. . . 310

Order LABYRINTHICI . . 312

1. Suborder **Ophiocephaloidei** 313

1. *Ophiocephalus* Bloch . . 313
1. marulioides Blkr. . . 315
2. melanopterus Blkr. . 315
3. striatus Bl. 317

page
4. melanosoma Blkr. . . 319
5. gachua H.B. 321
6. bistriatus nom. nov. . 322
7. bankanensis Blkr. . . 323
8. pleurophthalmus Blkr. 324
9. lucius (K.v.H.) C.V. . 326
10. micropeltes (K. v. H.) C. V. 328
Doubtful species:
1. punctatus Bl. . . . 330

2. Suborder **Anabantoidei** . 330

1. Fam. ANABANTIDAE . . 331
1. *Anabas* Cuvier . . . 333
1. testudineus (Bl.). . 334
2. *Polyacanthus* (K.v.H.) C. V. 337
1. hasselti C.V. . . . 338
3. *Helostoma* Cuvier . . 339
1. temmincki C.V. . . 340
4. *Trichogaster* Bloch, Schneider 341
1. fasciatus Bl. Schn. . 341
2. lalius (Ham. Buch.) 342
5. *Osphronemus* Lacép. . 343
1. goramy Lac. . . . 344
6. *Macropodus* Lacépède. 345
1. cupanus C.V. . . 346
2. opercularis (L.) . . 346
7. *Parosphromenus* Bleeker 348
1. deissneri Blkr. . . 348
8. *Sphaerichthys* Canestrini. 348
1. osphromenoides Canestrini 349
9. *Ctenops* Mc Clelland . 350
1. vittatus (C.V.) . . 351
Doubtful species.
1. nobilis Mc Clell. . . 352
10. *Betta* Bleeker 352
1. macrostoma Regan. 355
2. unimaculata (Popta). 355
3. fusca Regan . . . 356
4. akarensis Regan. . 357
5. anabatoides Blkr. . 357
6. patoti n.sp. . . . 359
7. picta C.V. 360
8. rubra Perugia . . 361
9. taeniata Regan , . 362
10. fasciata Regan . . 362
11. bellica Sauv. . . . 363
Doubtful species:
1. Betta pugnax (Cant.) 364
11. *Trichopodus* Lacépède. 365
1. trichopterus (Pall.). 366
2. leeri Blkr. 367

2. Fam. LUCIOCEPHALIDAE. 368
1. *Luciocephalus* Bleeker. 368
1. pulcher (Gray) . . 369

Order MICROCYPRINI Tate Regan 370

1. Fam. CYPRINODONTIDAE. 371
1. *Aplocheilus* McClelland 371
1. javanicus Blkr. . . 372
2. celebensis M. Web. 373
3. timorensis n.sp. . . 373
2. *Panchax* Cuvier & Valenciennes . . . 374
1. panchax (H.B.) . . 374

2. Fam. ADRIANICHTHYIDAE. 376
1. *Xenopoecilus* Tate Regan 377
1. sarasinorum (Popta). 378
2. poptae n.sp. . . . 379
2. *Adrianichthys* M.Weber 379
1. kruyti M. Web. . . 381

3. Fam. PHALLOSTETHIDAE. 381
1. *Neostethus* Tate Regan. 382
1. lankesteri Regan. . 382

Order HETEROMI Gill (Boulenger emend.).

Airbladder without an open duct. Body elongate, tail tapering to a point in recent forms. Scales cycloid; lateral line present. Orbito-rostral part of cranium elongate. Parietals meeting in the middle line, excluding the frontals from the supraoccipital. Pectoral arch suspended from supraoccipital or epiotic. Mesocoracoid arch absent, scapula lamellar. Opercle well developed. Fins with or without spines. Pectorals inserted high up the sides. Ventrals abdominal and not attached to cleithra. Anal very long, reaching end of tail; a caudal rudimentary or wanting. Anus posterior. Anterior vertebrae not modified. Mouth generally small, inferior, bordered by maxillaries and intermaxillaries or by the lastnamed only.

Embracing the recent *Halosauridae, Lipogenyidae* and *Notacanthidae* of which the first family only is represented in the indo-australian Archipelago.

---

1. Fam. HALOSAURIDAE.

Elongate, somewhat compressed, with the abdomen rounded; tail very long and strongly compressed, tapering into a filament, without caudal. Head conical, the facial bones with large muciferous cavities. The flattened snout projecting beyond the mouth, which is inferior, of moderate width and anteriorly bordered mesially by the intermaxillaries, laterally by the maxillaries. No barbels. Teeth small, in villiform bands on the jaws, on the rudimentary pterygoids and palatines, none on vomer or tongue. Scales rather small, cycloid, very deciduous; head, at least on cheeks, temples and on upper part of opercle scaly. Lateral line running along lower profile; its scales scarcely enlarged and destitute of luminous organs, or these organs are

present in membranous pouches on strongly enlarged scales. Dorsal behind ventrals, short; a second long rudimentary dorsal may be present. Anal occupying the entire length of the tail. Pectorals inserted high up; ventrals not very far back, they may be united by membrane. Gillopenings wide, gillmembranes entirely separate, with numerous branchiostegals. Praeoperculum rudimentary and detached from suspensorium, suboperculum enlarged, interoperculum membranous, operculum normally connected. No pseudobranchiae. Ovaries lamellated, open, the ova falling into the abdominal cavity.

Deep sea fishes of worldwide distribution between about the 40° N.Lat. and 46° S.Lat.

Key to the indo-australian genera of Halosauridae.

1. Vertex covered with scales; scales of lateral line scarcely enlarged, without luminous organs . . . . . *Halosaurus* p. 2.
2. Vertex scaleless; scales of lateral line much enlarged, with luminous organs . . . . . *Halosauropsis* p. 4.

1. Halosaurus Johnson.

(I. Y. Johnson, Proc. Zool. Soc. London 1863, p. 406).
Halosaurichthys Alcock Ann. Mag. Nat. Hist. (6) IV. 1889, p. 454 p. p.

Head with scales on cheeks, temples, vertex and in indo-pacific species also on snout. Scales of lateral line only slightly enlarged and without luminous organs. Head without angular ridges. The ventrals may be more or less united by membrane or totally free. A low median fold on the posterior dorsal part of the tail, covered by enlarged and elongated scales, may individually be present or absent.

For distribution see that of the family.

1. Halosaurus carinicauda (Alc.) [Fig. 1, p. 3].

Halosaurichthys carinicauda Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 454.
Halosaurichthys carinicauda Goode & Bean, Oceanic Ichthyology 1895, p. 136, 517.
Halosaurus carinicauda Alcock, Journ. Asiatic Soc. Bengal LXV. 1896, p. 336.
Halosaurus carinicauda Alcock, Descript. Catal. Indian Deep-Sea Fishes 1899, p. 187.
Halosaurus carinicauda Max Weber, Siboga-Expeditie, Fische 1913, p. 93.

B. 12—13; D. 10—11; V. 1.9; P. 14—15; L.l. ca 60 (between head and anus); L.t. 16—17.

Height about 18. Head 7—8, nearly $2^2/_3$ times in trunk, about one eye-length shorter than its distance from base of ventrals; covered by scales, the snout included. Snout conical, its length somewhat more than 2.5 times in that of head, the praeoral portion about 2.5 times in length of snout. Major diameter of eye 5 to more than 6 times in length of head, more than twice in postorbital part of head and less than twice the width of the interorbital space. Maxillary not reaching frontborder of eye. Origin of dorsal opposite to about middle of length of ventrals. Ventrals more or less united by membrane. (Pectorals broken). Scales deciduous. Those of the lateral line, which are without luminous organs, only slightly enlarged, about 60 between head and anus. On the tail the scales of the lateral line are separated from the anal by two, and more hindwards by one series of scales. Some scales in the middle line behind the dorsal may be enlarged and elongated, and in the posterior part of the tail these may be set in a low median fold of skin. Pterygoid bands of teeth narrow, scarcely separated from the palatine bands. Gillrakers short, not numerous. Uniform light-brown. The black covering of the buccal and branchial cavities shining through. Length 393 mm.

Habitat: Bali Sea (1008 M. fine mud)! — Andaman Sea (896 M.).

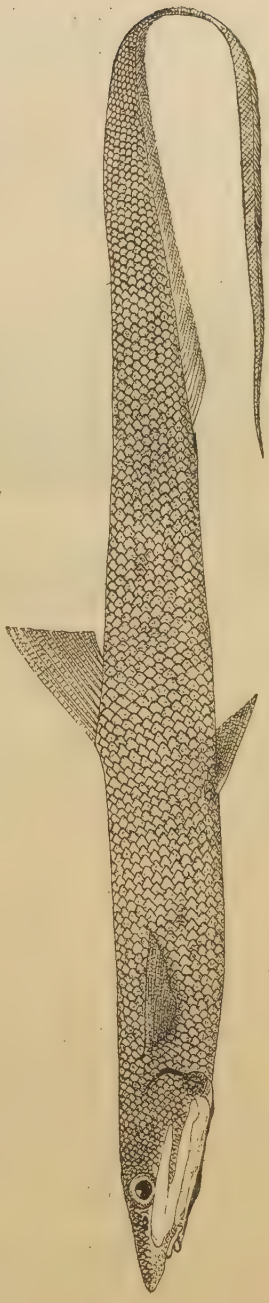

Fig. 1. *Halosaurus carinicauda* (Alc.). × $^2/_3$.

2. Halosauropsis Collett.

(Collett, Result. Campagnes sci. Hirondelle, Poissons, 1896, p. 143).
Aldrovandia Goode & Bean, Ocean. Ichth. 1895 (issued 1896), p. 608.

Head generally with scales, – often few in number – on cheeks, temples and upper part of opercle, none on vertex or snout. Scales of lateral line strongly enlarged and provided

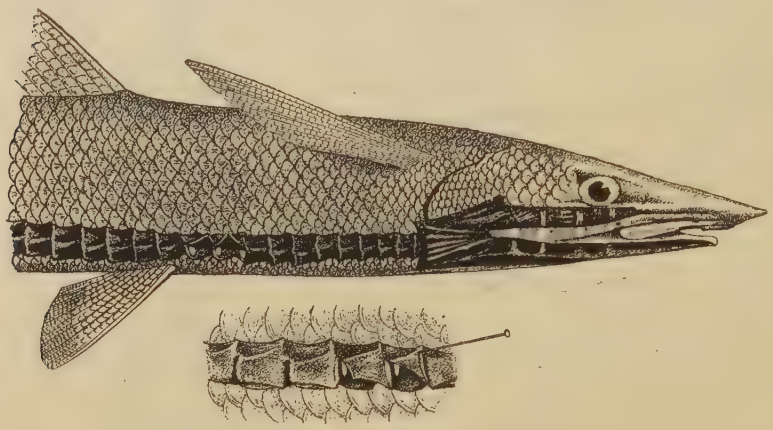

Fig. 2. Anterior part of *Halosauropsis macrochir* (Gthr.) and part of the lateral line with luminous organs (after Collett).

with luminous organs, which are also present in a suborbital and mandibulary series. Head with angular ridges. Base of ventrals united or not by membrane.

For distribution see that of the family.

Key to the indo-australian species of Halosauropsis.

1. Length of head $1\frac{1}{2}$ to 2 times in distance between head and base of ventrals. Ventrals almost entirely in advance of dorsal. P. with 8 rays. Lateral line with 20—25 enlarged scales between head and vent. . . . *H. mediorostris* p. 4.
2. Length of head about equal to distance between head and base of ventrals. Only anterior fourth of ventrals in advance of dorsal. P. with 10—13 rays. Lateral line with 30 enlarged scales between head and vent. *H. affinis* p. 5.

1. Halosauropsis mediorostris (Gthr.)

Halosaurus mediorostris Günther, Challenger Exped. XXII. Rep. Deep-Sea Fish. 1887, p. 239.

Halosaurus mediorostris Alcock, Journ. Asiat. Soc. Bengal LXIII. 1894, p. 136. — ibid. LXV. 1896, p. 336. — Descript. Cat. Indian Deep-Sea Fish. 1899, p. 185.
Halosaurus mediorostris Max Weber, Siboga-Exped. Fische, 1913, p. 94.

B. 11; D. 11; V. 1.8; P. 8; L. l. about 25 (between head and anus).

Height nearly 20. Head about $1^2/_3$ in trunk and $1^1/_2$ times to nearly twice in its distance from the root of the ventrals. Head naked, except for some scales on the upper half of the cheeks and the uppermost portion of the gillcover. Snout produced, its length about $2^1/_3$ in that of head, its praeoral portion not quite $^1/_3$ of its length. Eye more than 8, less than 4 times in postorbital part of head and less than $^2/_3$ of interorbital space. Maxillary reaching to, or slightly beyond front-border of eye. Origin of dorsal $2^1/_2$ eye lengths behind origin of ventrals, which are therefore almost entirely in advance of the dorsal. Ventrals not united by membrane. Pectorals with a very narrow base, longer than postrostral part of head and nearly reaching to ventrals. Scales very deciduous, those of lateral line much enlarged, bearing luminous organs; they are 20—25 or somewhat less in number between the gillopening and the vent. Pterygoid bands of teeth rather broad, separated from the palatine band by a considerable interval. Gillrakers numerous, close-set, rather long. Violet brown, end of tail somewhat darker. Bony parts of head silvery, the black covering of the buccal and branchial cavities shining through. Length 442 mm.

Habitat: Bali Sea (1018 M. fine mud)! — Near Philippine Islands (1288 M.); Arabian Sea (1315 M.).

2. Halosauropsis affinis (Gthr.)

Halosaurus affinis Günther, Ann. Mag. Nat. Hist. XX. 1877, p. 444.
Halosaurus affinis Bleeker, Verh. Akad. Amsterdam XVIII. 1877—1878, p. 21.
Halosaurus affinis Günther, Challenger Exped. XXII. Rep. Deep-sea Fish. 1887, p. 241.
Halosaurus anguilliformis Alcock, Ann. Mag. Nat. Hist. (6) IV. 1889, p. 453.
Halosaurus affinis Alcock, Ann. Mag. Nat. Hist. (6) VI. 1890, p. 309.
Halosaurus hoskynii Alcock, ibid. p. 309.
Halosaurus affinis Alcock, Journ. Asiat. Soc. Bengal LXV. 1896, p. 335.
Halosaurus hoskynii Alcock, ibid. p. 336.
Halosaurus anguilliformis Alcock, ibid. p. 336.

Halosaurus anguilliformis Alcock, Descript. Cat. Indian Deep-Sea Fish. 1899, p. 184 [1]).

Halosaurus affinis M. Weber, Siboga-Expeditie, Fische 1913, p. 93.

Halosaurus affinis Jordan, Tanaka & Snyder, Journ. Coll. Sci. Univ. Tokyo XXXIII. 1913, p. 40.

B. 10; D. 10—12; V. 1.8; P. 10—13; A. ca 175; L. l. about 30 (between head and vent); L. tr. ca 13—14 (between D. and V.).

Height about 17 to nearly 23; head 7—8, twice in trunk and about equal to its distance from base of ventrals. Head naked, except for a few scales on temples and cheeks. Snout produced, $2^1/_3$—$2^1/_2$ in length of head, its praeoral portion scarcely or more than half its length. Major diameter of eye 6.5 times or less in length of head, 2.5—3 times in postorbital part of it, nearly equal to interorbital space. Maxillary nearly reaches frontborder of eye. Origin of dorsal about one eye length behind origin of first outermost ventral ray. On the posterior dorsal part of the tail there may be indication of a very low median fold of skin, provided with slightly elongated scales. Base of ventrals united by membrane. Pectorals much longer than postrostral part of head. Scales extremely deciduous; those of the lateral line much larger than the other scales and provided with a luminous organ; these organs about 30 in number between the gillopenings and the vent. On the tail the scales of the lateral line are separated from the anal fin by one series of small scales only. The palatine bands of teeth are separated from each other as also from the pterygoid bands by a narrow interspace. Ten gillrakers, the 3 inferior ones short, the others nearly reaching half length of major diameter of eye. Light brown, end of tail somewhat darker as also upper side of head and snout. Otherwise the head is black; ventral side blackish. Length 525 mm.

Habitat: Timor Sea (383 M. and 618 M. mud)! — South of Japan (1033 M.); Arabian Sea off the Laccadive Islands (1829 M.); Gulf of Manár (1234 M.).

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1) *Halosaurus (Halosaurichthys) nigerrimus* Alcock, Ann. Mag. Nat. Hist. (7) II. 1898, p. 149 and Descr. Cat. Indian Deep-sea Fishes 1899, p. 188 from 459 fathoms off Maldives is probably a juvenile stage of *Halosauropsis affinis* Gthr. cfr. Max Weber, Siboga-Exped. Fische 1913, p. 93.

Order SOLENICHTHYES Regan.

Airbladder ductless. Body strongly elongate or short, more or less cylindrical, compressed or angular. Head produced in a larger or shorter tube-like snout, with a terminal, oblique, narrow mouth bordered by the small intermaxillaries only or also by the maxillaries. Body covered with scales, minute spinelets or naked; bony dermal plates are developed in various degree. Lateral line well developed, reduced to canals on head or absent. Teeth small, present or absent. A spinous and a soft dorsal, the first or the second or, by exception, both may be wanting. Anal present or absent. Ventrals abdominal, very large, rudimentary or absent, with 5—7 rays. Pectorals present or absent. Finrays of pectorals, second dorsal and anal distally not branched. Caudal may be absent, in which case the tail is prehensile. Gillopenings wide, or reduced to small dorsal apertures. Four gills, pectinate or lobate (*Lophobranchii*). Anterior 3—6 vertebrae immovably united. Ribs absent, as also parietals and opisthotics. Lower pharyngeals separate.

Marine fishes of large or small size of tropical and temperate seas, mostly living in shore-water, some entering fresh water.

Key to the indo-australian families of Solenichthyes.

I. Mouth toothed. Body covered with scales or minute spinelets or naked. Lateral line continuous. Two dorsal fins or a soft dorsal only. Ventrals abdominal with 6 soft rays. Four to five branchiostegals. Gillopenings wide. Gills pectinate . . . . . *Aulostomatidae* p. 8.

II. Mouth toothless. No lateral line.

1. Head and body covered with small rough scales. A dorsal and ventral cuirass of bony plates. Lateral line canals on head only. Two dorsal fins. Ventrals abdominal, small, composed of five soft rays. Four branchiostegals. Gillopenings wide. Gills pectinate . . . . . *Macrorhamphosidae* p. 15.

2. No scales. Body more or less encased in dermal bony plates. Lateral line canals absent.
   a. Two dorsal fins. Ventrals abdominal, rudimentary. Tail ventrally deflected, naked, moveable. Trunk encased in cuirass of bony plates. Four branchiostegals. Gillopenings of moderate width. Gills pectinate . . . . . *Centriscidae* p. 18.
   b. Two dorsal fins. Ventrals abdominal, large, with 1 spine and 6 rays. Skin with a longitudinal and transverse series of large stellate ossifications, rendering anterior part of trunk immoveable. One branchiostegal. Gillopenings wide. Gills lobate . . . . . *Solenostomidae* p. 24.
   c. One dorsal fin or none. No ventrals. Pectorals may be wanting. A complete cuirass of dermal bony plates forming rings round the body. One to three branchiostegals. Gillopenings reduced to small dorsal apertures. Gills lobate. *Syngnathidae* p. 30.

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1. Fam. Aulostomatidae.

Physoclists. Body elongate, covered with scales or with minute spinelets or naked, in which case there may be bony plates in various parts of the body, mostly covered by skin. Lateral line continuous. Tail short. Snout long, tubiform. Mouth terminal, not protractile, bordered by the small intermaxillaries, which are edentulous or provided with teeth, behind them the rather large maxillaries. Mandibles and vomer with minute teeth as also the palatines or pterygoids. Two nasal openings. Supraoccipital small, wedged in between the posterior part of frontals and excluded from occipital foramen; parietals wanting; posttemporal present, from it is suspended the cleithrum, with or without a supracleithrum (supraclavicular); postcleithrum (postclavicle) present. The 4 anterior vertebrae much elongate and suturally united into one piece; their transverse processes form a continuous lateral, their spinous processes a continuous vertical lamella. To it are fastened three median, long, bony nuchal shields covered by skin and to be regarded as modified interspinous (interneural) bones. Opercular apparatus well developed. Four or five branchiostegals. Gillmembranes separate, free from isthmus. Four complete, pectinate gills; gillrakers

obsolete; pseudobranchia present. First dorsal, if present, spinous, second dorsal opposite to anal, both are long or short. Caudal present. Rays of median fins not branched distally. Ventrals abdominal, with 6 articulated rays and the pelvic bones separated. Pectorals with 4 well developed pterygials, the 3 lower ones of which are enlarged.

Carnivorous fishes of tropical and subtropical seas.

Key to the subfamilies of Aulostomatidae.

1. Body compressed, scaly. A spinous and a long soft dorsal. Intermaxillaries edentulous. Anus far behind ventrals. A symphysial barbel. Caudal rhombic . . . . *Aulostomatinae* p. 9.
2. Body strongly depressed, without scales, or a single median dorsal and ventral row only. A soft dorsal only, which is short and posterior. Intermaxillaries with teeth. Anus close to ventrals. No symphysial barbel. Caudal incised, the 2 median rays prolonged into a filament . . . . . *Fistulariinae* p. 11.

1. Subfam. Aulostomatinae.

Body compressed, elongate, covered with small, ctenoid scales, wanting only on head and anterior part of back. Lateral line continuous, independent from scales. Supraoccipital small, wedged in between the frontals and laterally sided by the epiotics, which do not meet mesially. The long tubiform snout

Fig. 3. *Aulostoma valentini* (Blkr.). × 1/3.

is compressed. Intermaxillaries edentulous; mandibles with a small patch of teeth close to symphysis and a larger one further behind. Vomer anteriorly with a longitudinal patch of numerous minute teeth. Entopterygoids and metapterygoids each with an oval patch of teeth. Palatines without them. Lower jaw prominent, with a symphysial barbel. Spinous dorsal composed of isolated slender, rather weak spines. Soft dorsal and anal similar, rather long, composed of 23—29 rays of which the 4 anterior are spine-like. Anal immediately behind anus, which is situated far behind ventrals. Caudal small, rhombic. Supracleithrum (supraclavicle) absent. Four branchiostegals.

1. Aulostoma Lacépède.

(*Aulostomus* Lacépède, Hist. nat. Poissons V. 1803, p. 357).
Polypterychthys Bleeker, Nat. Tijdschr. Ned. Indië IV. 1853, p. 608.

For characters of the genus see those of the subfamily.
Shore fishes of tropical seas.

1. Aulostoma valentini (Blkr.) [Fig. 3, p. 9].

? *Aulostomus chinensis* Lacépède, Hist. nat. Poissons V. 1803, p. 357.
Aulostoma sinensis Schlegel, Fauna japon. Poissons, 1845, p. 520.
Polypterichthys Valentini Bleeker, Nat. Tijdschr. Ned. Indië IV. 1853, p. 608.
Aulostoma chinense Günther, Cat. Brit. Mus. III. 1859—1861, p. 538.
Aulostoma chinense Bleeker, Ned. Tijdschr. Dierk. I. 1863, p. 235 [1]).
Aulostomus valentini Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1902, p. 64.
Aulostomus valentini Jenkins, Bull. U. S. Fish Comm. XXII. (1902) 1904, p. 437.
Aulostomus valentini Jordan & Evermann, ibid. XXIII. (1903) 1905, p. 114.
Aulostomus valentini Max Weber, Siboga-Exped. Fische 1913, p. 100.
Aulostomus chinensis Jordan, Tanaka & Snyder, Journ. Coll. Sc. Univ. Tokyo XXXIII. 1913, p. 103.

D. VIII—XII. 24—27; A. 4. 22—25; P. 17; V. 6.

Elongate, compressed; height 11 to 12.5 in length without caudal, 13—14 with caudal. Head about 3 in length without caudal, $3^1/_3$—$3^2/_3$ with caudal, extremely compressed, especially the snout, the length of which goes $1^1/_2$ times in that of head and about 5 times in total length. Lower jaw longer than the upper one, prominent, hooked and with a short fleshy barbel at the symphysis. Posterior part and neck rugose. Praeoperculum and operculum with conspicuous striae. Eye about 10.5—12.5, contained $2^1/_3$—nearly 3 times in postorbital part of head and more than 7—8 times in length of snout. Soft dorsal posterior, beginning at some distance behind last spurious dorsal spine, equal in length to dorsal, which is opposite to it. Pectorals short, about twice diameter of eye. Origin of ventrals nearly midway between frontborder or middle of eye and base of caudal, much shorter than pectorals. Scales small, strongly ctenoid, head naked; lateral line continuous, slightly arched over base of pectorals. The colour shows variations. Generally it is uniform brownish with a series of ill defined longish, narrow white patches above and below lateral line or with 10—14 light narrow crossbars. It may also be

1) From this date Bleeker uses in the many lists of fishes which he succeedingly published the above name without giving any reason for the change.

yellowish, with light crossbars between the anal and dorsal. Often with a black spot near upper and lower margin of caudal, on base of ventrals, on middle of maxillaries and before eyes. Length 480 mm.

Habitat: Batu Islands; Sula Islands!; Banda!; Ambon!; Ternate; Ceram; Buru; Waigeu; New Guinea (Doreh). — Mossambique, Zanzibar, Madagascar, Bourbon, Seychelles, Japan (Riu Kiu Islands), South China, near Sydney [Mc Culloch], Lord Howe Island, Knob Island, Sandwich-, Society-, Paumotu Islands, Samoa, Honolulu.

A marine shore fish.

2. Subfam. Fistulariinae.

Body greatly elongate, much depressed, broader than deep. Skin totally naked, or covered with minute, conical, hooked spinelets, which persist or disappear with age; besides there may be a median, longitudinal single row of narrow keeled scales on back and ventral surface. Lateral line in the anterior part of the trunk curved towards the median line of the back in tube-shaped ossifications. Furtheron it bends downwards, running along the middle of the side. Here the tubes gradually take the form of narrow long bony shields with a more or

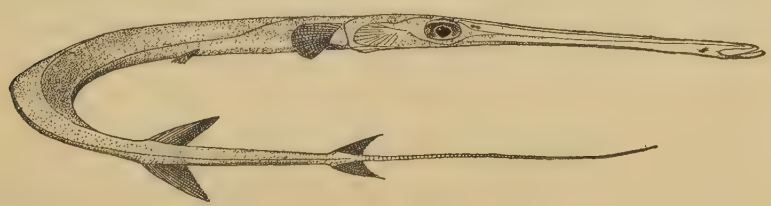

Fig. 4. *Fistularia petimba* Lacép. × 1/3.

less prominent keel or spine. The lateral line is continued on the caudal filament and again enclosed in tubes. Supraoccipital small between frontals and epiotics, which meet in the median line; behind them the mesially broadly united exoccipitals, which border the occipital foramen. The long, tubiform snout hexangular in transverse section. Intermaxillaries, mandibularies and pterygoids with a row of minute teeth, pterygoids edentulous. No symphysial barbel. No spinous dorsal. Soft dorsal short, posterior, with 16—18 rays, the 3 anterior of which are extremely short; anal opposite and similar, with 15—17 rays, the 2 anterior very short. It is situated far behind anus, which

is close to ventrals. Caudal incised, the 2 middle rays produced into a filament. Supracleithrum (supraclavicle) present. Five branchiostegals.

1. Fistularia Linné.

(Linné, Systema naturae edit. Xa, 1758, p. 312).
Cannorhynchus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1193.

For characters of the genus see those of the subfamily. Shore fishes of tropical seas.

Key to the indo-australian species of Fistularia.

Rough with spinelets; a single median row of narrow keeled scales before and behind the dorsal and the anal. Interorbital space deeply concave. Two middle ridges on upper surface of snout close together and parallel on anterior half of its length. *F. villosa* p. 12.

Naked; no median scales. Interorbital space nearly flat. Two middle ridges on upper surface of snout well separated, diverging on anterior part of snout, converging finally on its foremost part . . . . . *F. petimba* p. 14.

Remark. It is impossible to decide to which of the two above-named species belong the specimens quoted by different authors as: *Fistularia serrata* Cuv. or *Fistularia petimba* Lac., if there is no description added. This is also the reason why in our synonymy of the two species none of the numerous papers are quoted in which Bleeker mentions *F. serrata* or *immaculata* Cuv. from many localities.

1. Fistularia villosa Klunz. [Fig. 5, p. 13].

Fistularia serrata Cuvier, Règne anim. 1817, II. p. 349, secundum Bloch, Ichth 1794, tab. CCCLXXXVII, fig. 2 (p. p.).
? *Cannorhynchus immaculatus* Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1193.
Fistularia serrata Günther, Cat. Brit. Mus. III. 1859—1861, p. 533 (p. p.).
Fistularia villosa Klunzinger, Abh. zool. bot. Ges. Wien XXI. 1871, p. 516.
Fistularia serrata Günther, Challenger Reports VI. Shore fishes 1880, p. 68.
Fistularia petimba Jordan & Evermann, Fishes North and Middle America I. 1896, p. 758 (nec Lacépède).
Fistularia petimba Jordan & Snyder, Proc. U. S. Nat. Mus. XXIII. 1900, p. 350 (nec Lacépède).
Fistularia petimba Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1902, p. 67 (nec Lacépède).
Fistularia serrata Jenkins, Bull. U. S. Fish Comm. XXII. (1902) 1904, p. 437.
Fistularia serrata Jordan & Evermann, ibid. XXIII. (1903) 1905, p. 116.
Fistularia serrata Snyder, Proc. U. S. Nat. Mus. XLII. 1912, p. 408.
Fistularia petimba Max Weber, Siboga-Exped. Fische 1913, p. 101 (nec Lacépède).

Fistularia villosa Max Weber & de Beaufort, Zoöl. Mededeelingen, Museum Leiden VI. 1921. p. 64.

D. 13—15; A. 13—15; P. 1.14—1.16; V. 6.

Skin rough with spinelets, feeling harsh like very fine shagreen. A single median row of very narrow somewhat keeled and more or less distant scales along the back, from about the level of the ventrals to the base of the dorsal and behind it to some distance from the end of the tail; a similar but less conspicuous row, beginning at some distance in front of the ventrals and running to some distance from caudal, interrupted by the anus and anal. These scales are not yet developed in small specimens (170 mm. JUNGERSEN) [1]). Height to 38 times in length (without caudal filament); somewhat less than width of body. Head 2.5—3.5 times in length (without caudal filament). Horizontal diameter of eye 11 to 12 times in head, 8.5 to nearly 9 times in length of snout and about twice longer than interorbital space, which is deeply concave. Lateral edge of snout (formed by praefrontal and upper margin of metapterygoid) sharply serrated. The 2 median ridges on upper surface of snout not far distant and parallel on anterior half of its length, finally and slowly converging anteriorly. Posterior part of head more deeply sculptured and all the ridges rougher. Height of dorsal and anal about twice the horizontal diameter of the eye. Colour brownish above, white below, sometimes with faint traces of broad crossbars. Tips of dorsal, anal and caudal dusky. Young specimens in alcohol uniform light brown. Length till 1500 mm.

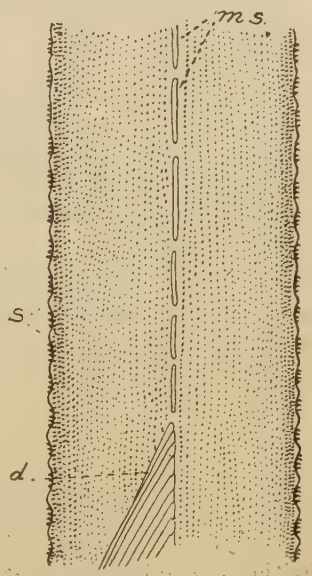

Fig. 5. *Fistularia villosa* Klunz. Upper view of praedorsal part. *d* dorsal, *m s* median dorsal scales, *s* spinelets. × 4.

Habitat: Nias!; Sumatra!; Borneo!; Java Sea!; Madura!; Sumbawa!; Timor (Kupang!); Saleyer!; Siau Island!; Kajoa!; Ambon!; Ternate; Batjan; Ceram!; Damar Island!; Kur Island!;

1) Jungersen, Danske Vidensk. Selsk. Skrifter. København 7. R. Afd. VIII. 5, 1910, p. 282.

Banda!; Aru Islands!. — From Aden, the East coast of Africa and Madagascar through the Indic to South-China, Japan and the Hawaiian and other Pacific Islands.

2. Fistularia petimba Lacép. [Fig. 4, p. 11].

Fistularia petimba Lacépède, Hist. nat. Poiss. V. 1803, p. 349 (s. syn.).
Fistularia serrata Günther, Cat. Brit. Mus. III. 1859—1861, p. 533 (p. p.).
Fistularia serrata Klunzinger, Abh. Zool. bot. Ges. Wien XXI. 1871, p. 515.
Fistularia depressa Günther, Challenger Reports, VI. Shore Fishes 1880, p. 69. — Fische d. Südsee II. 1881, p. 221.
Fistularia depressa Jordan & Evermann, Fishes North & Middle America I. 1896, p. 757.
Fistularia depressa Seale, Occas. Papers Bishop Mus. I. 1901, p. 64.
Fistularia depressa Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1902, p. 66.
Fistularia petimba Jenkins, Bull. U. S. Fish Comm. XXII. (1902) 1904, p. 437.
Fistularia petimba Snyder, ibid. p. 523.
Fistularia petimba Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 116.
Fistularia petimba Seale, Occas. Papers Bishop Mus. IV. 1906, p. 17.
Fistularia petimba Steindachner, Sitzb. Akad. Wien CXV. 1906, p. 1419.
Fistularia petimba Snyder, Proc. U. S. Nat. Mus. XLII. 1912, p. 408.
Fistularia depressa Max Weber, Siboga-Exped. Fische, 1913, p. 101.
Fistularia petimba Max Weber & de Beaufort, Zool. Mededeelingen Museum Leiden VI. 1921 p. 64.

D. 14—17; A. 14—16; P. 1.14; V. 6.

Skin naked, everywhere smooth to touch. Height in length (without caudal filament) to 40; about 2—$2^1/_2$ times in width of body. Head somewhat more or less than $2^2/_3$ times in length (without caudal filament). Horizontal diameter of eye more than 8 to 15 times in head, about 7—8 times in length of snout and twice to thrice longer than interorbital space, which is nearly flat. Lateral edge of snout (formed by praefrontal and upper margin of metapterygoid) serrated. The 2 median ridges on upper surface of snout well separated, diverging on anterior half, converging finally on foremost part of it. Ridges and serrations on posterior part of head weak. Height of dorsal and anal about twice the horizontal diameter of the eye. Brown above, lighter or white below. In life with a pair of anteriorly and posteriorly interrupted blue stripes, beginning at the nape and running on tail above and parallel to lateral line. Length to about 1500 mm.

Habitat: Pulu Weh!; Nias!; Borneo!; Celebes (Makassar! Menado!); Sula Islands!; Ambon!; Ceram!; Gisser!; Obi Major!; Waigeu!; North New Guinea (Joutefa Bay!). — From the East

coast of Africa through the Indic and Pacific to the West coast of tropical America (California, Mexico) and to Japan and Australia.

Remark. Of this species, which is often confounded with the preceding one, *larger* specimens are better represented in collections from our region than of *F. villosa* Klunz. One gets the impression, that, when young, both are living in the shore water, where *F. petimba* Lac. grows to a large size, and is easily captured, while *F. villosa* Klunz., when growing larger, lives outside the shore water and seems therefore to be rarer.

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2. Fam. Macrorhamphosidae.

Physoclists. Body oblong or elevated, compressed. Head produced into a long tube formed by the prolonged bones of the mandibulary suspensorium and the anterior prolongation of the praeoperculum. The other opercular bones are well developed. Of the true mouthparts the intermaxillaries are weak, the maxillaries fairly broad, the mandibles well developed, all

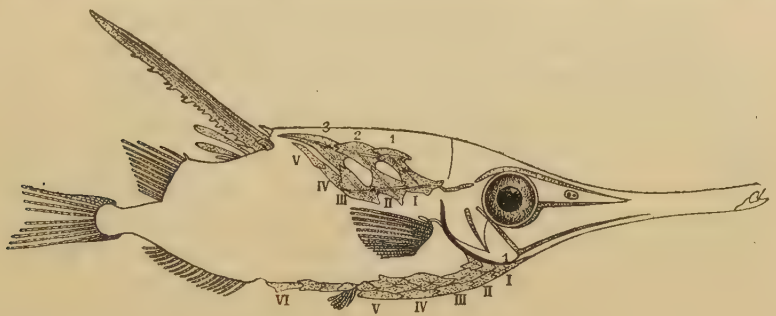

Fig. 6. *Macrorhamphosus scolopax* L. n. s., to show the larger scutes and the crests on the head, while the scales are ommitted. Dorsal armour: 1, 2, 3 upper dorsal row of plates; I—V, lower lateral row. Ventral armour: I—VI row of unpaired keeled scutes, above them the paired scutes. (After Jungersen).

the bones are without teeth as also vomer, palatines and pterygoids. The parietals are wanting. No lateral line; lateral line canals on head present. Head and body all over covered by small, rough scales, formed by a scaly plate in the epidermis, with the hindborder more or less toothed and with one or more keels on its surface. Each scale is connected by a stalk with a bony plate imbedded in the cutis. Besides the trunk is armoured with large bony plates, which make it stiff and immoveable and which are partly hidden by the scales (see Fig. 6).

The ventral part of this armour, reaching from the isthmus to the anus, broken only by the groove for the ventrals, produces the sharp ventral keel. The dorsal cuirass is formed by 2 rows of bony plates, the lower of which are partly connected with the transverse processes of the vertebrae. The 5 anterior vertebrae are elongated and much stouter than the others. Spinous and soft dorsal continuous with or separated from each other, or both are connected by a series of short, isolated spines. Anal as also the soft dorsal are of moderate extent. Ventrals small, abdominal, without spine. Pectorals inserted more or less midway the height of the body. Their 4 pterygials are stout but short. The cleithrum is suspended from the posttemporal, which forms part of the skull. Four branchiostegals. Four complete pectinate gills; pseudobranchia large; gillopening wide.

Small fishes living in temperate and tropical part of Atlantic, Indo-Pacific and Mediterranean.

1. Macrorhamphosus Lacépède.

(Lacépède, Hist. nat. Poissons V. 1803, p. 136).
Centriscus Cuvier, Règne anim. II. 1817, p. 350 (nec Linné).
Orthichthys Gill, Proc. Acad. Sc. Philadelphia 1862, p. 234.

Dorsal armour consisting on each side of two series of bony plates, each series formed by 3 well-developed and a fourth much smaller plate. Dorsal fins not continuous but separated by an interspace or connected by a series of short isolated spines. First dorsal spine short. No patch of bristles on nape. For other characters see those of the family.

Distribution: Tropical and temperate seas of both hemispheres. Pelagic fishes with weak power of swimming and able to be transported and distributed by currents.

1. Macrorhamphosus velitaris (Pallas). [Fig. 7, p. 17].

Centriscus velitaris Pallas, Spicileg. Zool. VIII. 1770, p. 37.
Centriscus sumpit Lacépède, Hist. nat. Poiss. II. 1800, p. 93.
Centriscus velitaris Bloch, Schneider, Syst. ichth. 1801, p. 113.
Centriscus velitaris Günther, Cat. Brit. Mus. III. 1859—1861, p. 524.
Orthichthys velitaris Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 274 (no description).
Centriscus brevispinis Kner & Steindachner, Sitzb. Akad. Wien LIV. 1866, p. 374.
Centriscus velitaris Lütken, Spolia Atlantica, Dansk. Vidensk. Selsk. Skrifter (V.) 12, 1880, p. 585.
? *Centriscus gracilis* Günther, Fische d. Südsee, 1881, p. 222.
Macrorhamphosus hawaiensis Gilbert, Bull. U. S. Fish Comm. (1903) 1905, p. 613.

Macrorhamphosus velitaris Max Weber, Tijdschr. Ned. Dierk. Ver. (2) XI. 1909, p. 74.

Macrorhamphosus velitaris Regan, Ann. Mag. Nat. Hist. (8) XIII. 1914, p. 17, 20.

D. III. 10—12; A. 18; P. 13—15; V. 5.

Height 4 to more than 5; head twice to $2^1/_2$. Snout $3^1/_2$ to more than 4 in length, 1.7 in length of head. Eye $4^1/_2$—6 in length of head, $2^1/_2$—$3^1/_2$ in length of snout; its diameter less than the length of the postorbital part of the head. First dorsal spine short, originating behind vent and far behind middle of length. Second spine somewhat shorter than half

Fig. 7. *Macrorhamphosus velitaris* (Pall.) $2^1/_4$ n. s. (After GILBERT).

length of head, provided with small spinelets along its posterior edge. Third spine somewhat shorter than half length of second spine. Colour silvery, darkish on back and top of head. Length 85 mm.

Habitat: Ambon. — Samoa, Hawaii and according to REGAN East Africa, Indian Ocean, China and the Mediterranean.

Note: GÜNTHER doubted very much that this fish came from the East indian Archipelago as asserted by PALLAS, as it had not been recognized again after his description. But PALLAS says that he received the fish from J. A. SCHLOSSER, who communicated it to him together with *Callionymus sagitta* Pall. and *Fistularia paradoxa* Pall. (*Solenostomus paradoxus* Pall.). SCHLOSSER got these fishes from Ambon and it is quite well known, that the two last-named species really occur near that island. So it may be allowed to conclude, that also the *Centriscus velitaris* of PALLAS came from that locality. This conclusion is strengthened by the fact that *Macrorhamphosus velitaris* is now also known from China, Samoa and Hawaii.

3. Fam. Centriscidae.

Physoclists. Body elongate, extremely compressed with scharp ventral edge. Head produced into a long tube with the mouth terminal, small and toothless. Trunk ending posteriorly in a long strong spine with or without a movable spine at its end. Below it are situated 2 dorsal fins, a spinous dorsal, close to the strong spine and a soft one directed downward. The longitudinal axis of the short, movable tail is deflected at an obtuse angle from that of the trunk and terminates in a short caudal. The anal lies close before it. Body for its greater part transparent and encased in a dorsal and ventral exoskeletal unflexible cuirass. The former is composed of two alternating

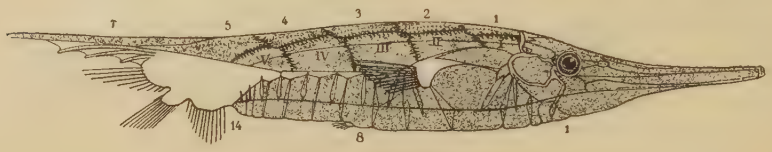

Fig. 8. *Centriscus scutatus* L.
Dorsal cuirass: 1—5 upper dorsal row of plates. I—V lower lateral row. The line running through those plates corresponds to the inner ridge connected with the vertebral column.
Ventral cuirass: 1—14 ventral plates; 8 with the ventrals. T dorsal spine. (After Jungersen).

rows of 5 bony plates, each connected by suture. The lower (or lateral) row of plates, across which runs the lateral line, is connected with the vertebral column. Behind the fourth plates of the upper row and wedged in between the fifth plates of that row is situated an unpaired plate covering the base of the terminating strong spine. In *Aeoliscus* there is another small, unpaired endoskeletal plate anteriorly in the middle line of the back between the posterior ends of the first pair and the anterior ends of the second pair of plates of upper row. The ventral cuirass consists of a row of 13—15 exoskeletal plates. Anterior 5—6 vertebrae elongated, the transverse processes of the second to fourth or fifth connected with the dermal plates. In the skull the parietals are wanting; the true mouthparts are small. The prolongation of the snout is produced by the prolonged mandibulary suspensorium and by the praeoperculum developed into a thin, transparent plate, anteriorly attached to the prolonged quadrate. Other opercular bones well developed. The ventrals are abdominal, more or

less rudimentary, inserted on the 8th plate and coalesced along their inner margin; they have a spinous and 4 soft, but unarticulated and unbranched rays, which may be prolonged in males (of *Aeoliscus strigatus*). The pectorals are inserted on the middle of the depth of the body at a considerable distance from the head. Their 4 pterygials are stout but short. The cleithrum is suspended from the posttemporal which is suturally united to the skull. Part of the cleithrum is covered by the dorsal cuirass; the scapula with a large foramen; postcleithrum (postclavicle) and supracleithrum (supraclavicle) present. Four branchiostegals. Four complete pectinate gills; pseudobranchia large.

Small fishes living in small shoals in shallow water of the tropical indopacific.

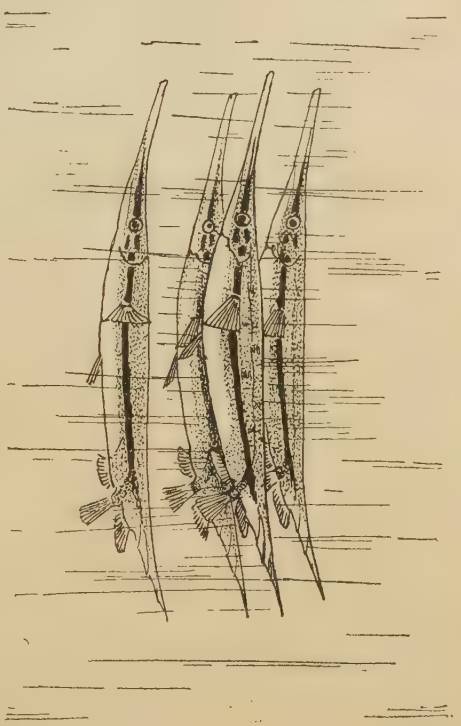

Fig. 9. *Shoal* of *Aeoliscus strigatus* (Gthr.) in attitude of swimming. They are represented as if swimming from right to left. (After Willey).

About the position of these fishes in water, which one of us has observed as a normal one, it is said by other observers that it is a vertical one, with the head upwards or according to still an other observer with the head downwards.

Key to the genera of Centriscidae.

1. Dorsal spine with a movable spinous ray at its end. Interorbital space striated, convex, without longitudinal groove. *Aeoliscus* p. 20.
2. Dorsal spine without a movable spinous ray at its end. Interorbital space convex or with a groove continued to the crown of the head, which is striated. . . . . *Centriscus* p. 21.

1. Aeoliscus Jordan & Starks.

(Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1902, p. 71).
Amphisile Cuvier, Règne anim. II. 1817, p. 350 p.p.

Besides the unpaired plate behind the fourth plates of upper row of dorsal cuirass (see description of family) there is a median unpaired plate anteriorly between the posterior ends of the first pair and the anterior ends of the second pair of

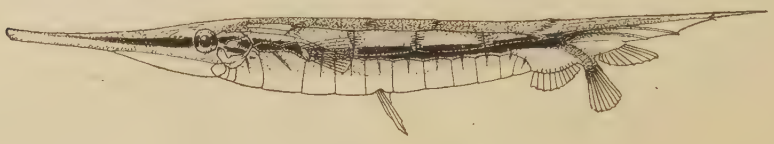

Fig. 10. *Aeoliscus strigatus* (Gthr.). $^4/_5$ n. s.

the dorsal plates. To the end of the strong spine of the dorsal cuirass is jointed a movable spinous ray. Interorbital space convex and striated without a longitudinal groove. For other characters see those of the family.

Distribution: From Red Sea and the East coast of Africa through Indic and Pacific to Westpacific Islands, Japan and Australia.

Living near shore.

1. Aeoliscus strigatus (Gthr.) [Fig. 10, p. 20]

Amphisile scutata Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 245. (nec L.)
Amphisile scutata Steindachner, Verhandl. zool. bot. Gesellsch. Wien X. 1860, p. 765. (nec L.)
Amphisile strigata Günther, Cat. Brit. Mus. III. 1859—1861, p. 528.
Amphisile strigata Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 144 ("= *Amphisile scutata* Blkr. ol. plur. loc. (nec Cuv.)").
Amphisile strigata Lütken, Vidensk. Med. Naturh. Foren. Kjöbenhavn, (1865) 1866, p. 216.
Amphisile strigata Günther, Fische der Südsee, 1881, p. 222.
Aeoliscus strigatus Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1902, p. 71.
Amphisile strigata Jungersen, Danske Vidensk. Selsk. Skrifter København 7. R. Afd. VI. 2, 1908, p. 44.
Aeoliscus strigatus Max Weber, Siboga-Expeditie, Fische, 1913, p. 98.

D. III. 9—10; A. 11—12; P. 11—12; V. 4.

Height 8—9; head somewhat more or less than $2^1/_2$ in length to base of soft dorsal rays, about 3 times in length to end of terminal spine. Eye 11—12, more than $1^1/_2$ to twice in postorbital part of head, about $8^1/_2$ times in snout, which goes about $1^1/_3$ in length of head. Interorbital space convex, longi-

tudinally striated, equal to diameter of eye. Movable spine, articulated with terminal spine, more or less curved, to 11 mm. long. Operculum oval, about $^1/_3$ longer than high. Length of postorbital part of head slightly less than half the distance of the base of pectorals from hindborder of operculum. The distance of the ventrals from the pectorals about equal to that of the latter from the eye. Colour yellowish or brown, lighter above; a dark streak beginning from snout running in the middle of the height to base of caudal. Length 140 mm.

Habitat: Pulu Weh!; Sumatra; Simalur!; Nias!; Batu Islands; Java (Batavia); Flores!; Celebes (Makassar!, Menado!); Saleyer!; Buton!; Sanghir Islands; Biaru Island!; Buru; Ternate; Ambon!; Obi!; Halmaheira; Banda; Aru!; Waigeu!; Goram; New Guinea. — Persian Gulf, Muscat (Regan), Philippines, Japan, Riu Kiu Islands, Pelew Islands, Cape York, Solomon Islands (Ogilby).

2. Centriscus Linné.

(Linné, Systema Naturae edit. X. 1753, p. 336).
Amphisile Cuvier, Règne anim. II. 1817, p. 350 p. p.
Acentrachme Gill, Proc. Acad. nat. sc. Philadelphia 1862, p. 204.

Dorsal cuirass with only one unpaired plate situated behind the fourth plates of the upper row and wedged in between the fifth plates of that row. The dorsal cuirass terminates in

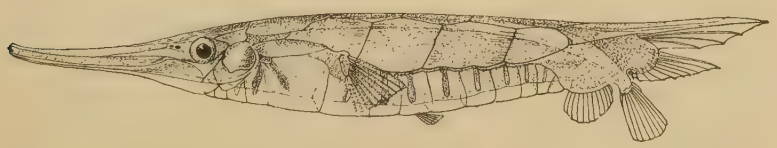

Fig. 11. *Centriscus scutatus* L. $^2/_3$ n. s.

a long, strong spine, to which no separate dorsal spine is jointed. Interorbital space with or without a groove, continued to the crown of the head, which is striated and crenulated.

Distribution: From Red Sea(?) and Madagascar through Indic to Australia, Philippines and Southern China.

Living in somewhat deeper water near shore.

Key to the indo-australian species of Centriscus.

1. Interorbital space with a groove continued to the crown of the head; sutures of lateral plates serrated. Postorbital

part of head half or more than half the distance of the operculum from base of pectorals . . . . . *C. scutatus* p. 22.

2. Interorbital space convex, without groove; sutures of lateral plates smooth. Postorbital part of head thrice in distance of the operculum from base of pectorals. . . . . *C. cristatus* p. 23.

1. Centriscus scutatus L. [Fig. 8 p. 18 and Fig. 11, p. 21].

Centriscus scutatus Linné, Syst. Nat. edit. X. 1753, p. 336.
Centriscus scutatus Bloch, Ausländ. Fische I. 1785, p. 57.
Centriscus scutatus Bloch, Schneider, Syst. ichth. 1801, p. 113.
Amphisile scutata Günther, Cat. Brit. Mus. III. 1859—1861, p. 525.
Amphisile macrophthalma Steindachner, Verhandl. zool. bot. Gesellsch. Wien X. 1860, p. 766.
Amphisile (Acentrachme) scutata Lütken, Vidensk. Medd. naturh. Foren. Kjöbenhavn 1865, p. 215.
Acentrachme scutata Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 144.
Acentrachme pachyacanthus Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 274 (secundum *Amphisile scutatus* Guérin, Iconographie Règne animal II. Poissons tab. 45, f. 3; no description).
Centriscus scutatus Bleeker, Versl. Akad. Amsterdam (2) II. 1868, p. 298 ("= *Acentrachme scutata* Gill").
Amphisile scutata Klunzinger, Abhandl. zool. bot. Gesellsch. Wien XXI. 1871, p. 516.
? *Amphisile Finschii* Hilgendorf, Sitzb. Gesellsch. Naturf. Freunde Berlin 1884, p. 53.
Amphisile scutata Day, Fishes India 4°, 1878—1888, p. 361.
Centriscus scutatus Jordan & Seale, Bull. Bureau fisheries, Washington XXVI. (1906) 1907, p. 9.
Amphisile scutata Jungersen, Danske Vidensk. Selsk. Skrifter København (7) Afd. VI. 2. 1908, p. 44.
Centriscus scutatus Max Weber, Siboga-Expeditie, Fische, 1913, p. 99.

B. 3; D. III. 10—12; A. 11—12; P. 10; V. 3—4.

Height $6^1/_2$—$7^1/_2$ in length to end of terminal spine, more than 6 times in length to root of caudal. Head about 3, about $2^1/_2$ to base of soft dorsal rays, somewhat less to root of caudal. Snout 1.2—1.4 in head. Eye 8 [1]) to nearly 9, about 11 times in head, about 6.3 to 9 times in snout. Operculum somewhat quadrangular with rounded corners, nearly oval, somewhat longer than high. Distance of eye from hindborder of operculum is half or conspicuously more than half the distance of the operculum from base of pectorals. Distance of pectorals from ventrals much less than distance of pectorals from hindborder of eye. Crown of head striated, with a longitudinal groove extending to between the eyes. Sutures of lateral plates

1) According to Steindachner (l. s. c.).

serrated. Colour silvery, a dark lateral band from head to tail, may be present in preserved specimens. Ventral plates with 7—8 narrow silvery crossbars, which are very conspicuous in case the ventral plates are golden. Length 150 mm.

Habitat: Singapore; Nias!; Lombok!; Celebes!; Buru; Ambon!; Halmahera; Ceram; Banda!; Waigeu; Aru Islands (Dobo!); Timor!. — Red Sea; Madagascar; Muscat; Gulf of Manár; Ceylon; Philippines; China; Thursday Island; New Caledonia? (Jouan).

Living near shore in depths up to 80 M.

2. Centriscus cristatus (De Vis).

Amphisile cristata De Vis, Proc. Linn. Soc. N. S. Wales IX. 1885, p. 872.
Amphisile scutata Kent, Great Barrier Reef 1893, p. 307 (nec L.)
Centriscus scutatus Waite, Rec. Austr. Mus. VI. 1905, p. 59 (nec L.).
Centriscus cristatus J. D. Ogilby, Ann. Queensl. Mus. N°. 10, 1911, p. 41.
Centriscus cristatus A. R. McCulloch, Biol. Results "Endeavour" III. 1915, p. 105.

D. III. 12; A. 13—14; P. 12; V. 3.

Height 4.65—5.15 in length to root of caudal, becoming much higher with age; head 2.7—3.4 in same length. Snout 1.3 in length of head. Eye 1—2.4 in postorbital part of head, equal to or little more than the interorbital space, which is strongly convex, longitudinally striated. Operculum tetragonal as long as or little longer than high. Distance of eye from hindborder of operculum about $^1/_3$ of the distance of the operculum from base of pectorals. Sutures of lateral plates smooth. Colour in preserved specimens more or less silvery. A dark band from snout through eye extending along the sides to root of dorsal. Length 300 mm. [not seen by us].

Habitat: Queensland, western Australia, Houtman Abrolhos [1]).

In shore water to 30 M. depth.

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1) In the list of fishes collected by Semon (Max Weber in Semon, Zool. Forschungsreise Australien etc. V. 1895, p. 268) one of us named also *Amphisile scutata* (L.) from Thursday Island. A. R. Mc Culloch (Biol. Results "Endeavour" III. 1915, p. 105) has quoted this statement under the synonyms of *Centriscus cristatus* de Vis, without having seen the specimen. The distinguished australian ichthyologist was probably under the impression that a specimen of *Centriscus* from Thursday Island must belong to the australian species *C. cristatus* de Vis. This is an error, the Thursday Island-specimen is *Centriscus scutatus* L. Nevertheless we thought it advisable to enlist *C. cristatus* de Vis as it is not improbable that this species will be found along the south coast of New Guinea.

4. Fam. Solenostomidae.

Physoclists. Body compressed, tail very short with an extremely long and broad caudal fin; much produced snout a strongly compressed tube through transformation of symplecticum, quadratum and anterior part of praeoperculum into long and high plates. Mouth small, terminal, oblique, bordered above by the intermaxillaries, which are edentulous like the maxillaries, mandibularies, palatines, pterygoids and vomer. Vertebrae without articular processes; the 3 anterior vertebrae suturally united. Skin with large stellate ossifications, leaving large interspaces naked, arranged in longitudinal and transverse-series, forming an uninterrupted dorsal and ventral median keel before first dorsal and ventrals, rendering the anterior part of the trunk immovable. No visible lateral line. Olfactory

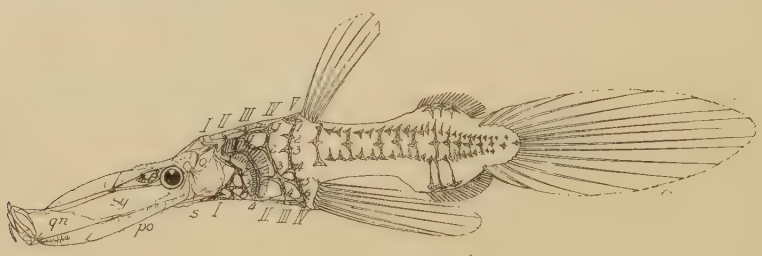

Fig. 12. *Solenostomus cyanopterus* Blkr. ♂
showing dermal skeleton. I—V Superior row of unpaired median scutes; I—IV Inferior row of unpaired scutes; 1—6 members of the thoracic transverse rows of scutes; *o* operculum, *s* suboperculum, *po* praeoperculum, *sy* symplecticum, *qn* quadratum (After Jungersen).

organ an open pit, smooth in the female, provided with radiating lamellae in the male. The posttemporal (attached to skull) and the supracleithrum are similar to the stellate ossifications; otherwise the pectoral arch is normally attached to the skull; pterygials elongated, the lowermost by far the largest. Ventrals abdominal, opposite to spinous dorsal; the soft dorsal opposite to anal, both with numerous unbranched rays, like those of the rounded pectorals and the caudal. Operculum well developed. Gillopenings wide. Four complete lobate gills; pseudobranchia large. One bifid branchiostegal.

Marine fishes constituting a single genus.

1. Solenostomus
Lacépède.

(LACÉPÈDE, Hist. nat. Poissons V. 1803, p. 361).

Anterior dorsal with 5 spines, short but high; posterior or soft dorsal and anal opposite, long but low, with elevated base and 18—23 rays. They are unbranched, like those of the caudal and the pectorals, which are extensive, rounded but short. Ventrals opposite spinous dorsal, very large with 1 spine and 6 bifurcated rays; free in the male, in the female with their inner margin adnate to abdomen, their outer margins united at their base for a short distance, forming a large pouch for the reception of the eggs, which are fastened by peduncles on thread-like filaments of the abdominal skin.

For other characters see those of the family.

Distribution: From Red Sea, East Africa, Madagascar, Mauritius, Indic, through indo-australian Archipelago, to China and Japan.

Living partly in shallow water among sea-weeds, partly in deeper water.

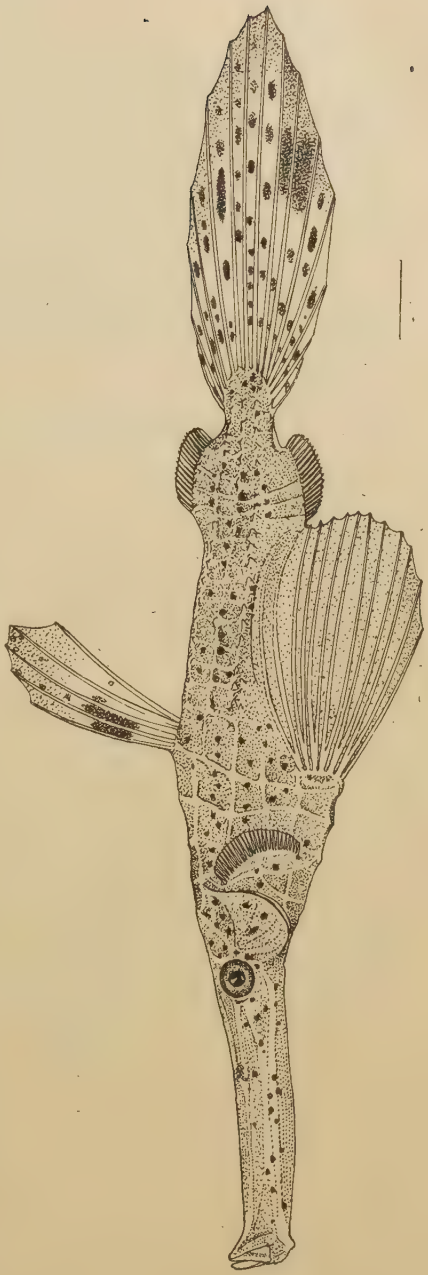

Fig. 13.
Solenostomus cyanopterus Blkr.
1.1 × after JORDAN & SNYDER.

Key to the indo-australian species of Solenostomus.

1. Caudal peduncle rather higher than long. Membrane of caudal beginning very near or almost close to 2. dorsal and anal . . . . . *S. cyanopterus* p. 26.
2. Caudal peduncle longer than high. Membrane of caudal beginning at a distance from 2. dorsal and anal of more than half the length of the base of these fins . . . . . *S. paradoxus* p. 27.
3. Caudal peduncle about thrice longer than high. Membrane of caudal beginning at a distance from 2. dorsal and anal, which is longer than base of these fins . . . *S. armatus* p. 28.

1. Solenostomus cyanopterus Blkr. [Fig. 13, p. 25].

Solenostoma paradoxum Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 308 (nec Pallas).

Solenostoma paradoxum Bleeker, Verh. Bat. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen p. 29 (nec Pallas).

Solenostoma cyanopterus Bleeker, Nat. Tijdschr. Ned. Indië VI. 1854, p. 507.

Solenostoma cyanopterus Bleeker, Nat. Tijdschr. Ned. Indië VIII. 1855, p. 434.

Solenostoma paradoxus Kaup, Cat. Lophobranchiate Fish London 1856, p. 2 (p.p.) [1]).

Solenichthys cyanopterus Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 183 — ibid. p. 273.

Solenostoma cyanopterum Playfair & Günther, Fishes Zanzibar 1866, p. 137.

Solenostomus cyanopterus A. Duméril, Hist. nat. Poiss. II. 1870, p. 497.

Solenostomus Bleekeri A. Duméril, ibid. p. 498.

Solenostoma cyanopterum Günther, Cat. Brit. Mus. VIII. 1870, p. 151.

Solenostoma cyanopterum Klunzinger, Abhandl. zool.-bot. Ges. Wien XXI. 1871, p. 654.

Solenostomichthys cyanopterus Bleeker, Ned. Tijdschr. Dierk. IV. 1873, p. 126.

Solenostomatichthys Bleekeri Bleeker, Enumération Poiss. de Madagascar in: Recherch. s. l. Faune de Madagascar Leide, 1875, p. 76 — Verh. Akad. Amsterdam XVIII. 1877—1878, Poiss. de Maurice, p. 17.

Solenostomus Bleekeri Sauvage, Poissons in: Grandidier, Hist. nat. Madagascar XVI. 1891, p. 503.

Solenostomus cyanopterus Jordan & Snyder, Proc. U. S. Nat. Mus. XXIV. 1901, p. 4.

Solenostomus cyanopterus Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 118.

Solenostoma cyanopterus Jungersen, Danske Vidensk. Selsk. Skrifter København (7) VIII. 5. 1910, p. 328.

Solenostomus cyanopterus Max Weber, Siboga-Expeditie, Fische 1913, p. 104.

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1) Kaup quotes as locality "sea of Hawaii" according to Bleeker. This is totally erroneous as Bleeker gives for locality Wahai on the north coast of Ceram. This misunderstanding is repeated in the papers by Jordan & Snyder, by Jordan & Evermann, by Jordan & Seale and by Jordan, Tanaka and Snyder.

D. v. 18—20; A. 16—20; P. 24—27; V. 7.

Height in total length nearly 6—8; head in total length 3 to about $3^1/_3$. Eye 11, 3—$3^1/_3$ in postorbital part of head. Eye in snout (according to size of the fish) $6^1/_4$—$8^1/_3$. Least height of snout, which is higher in the male than in the female, about $4^1/_2$ times in its length (3 times in the male, 4 times in the female, JUNGERSEN) to $5^1/_2$ times (SAUVAGE). Caudal peduncle stout, rather higher than long. The membrane of the caudal beginning very near or almost close to the second dorsal and anal, closest in the male. Posterior margin of ventrals evenly convex in both sexes. Skin with more or less conspicuous scattered dermal appendages, more so in the male; these villi, which may be branched, also along inferior border of snout; they form a barbel at the mandibular symphysis. Colour brown or pink, dotted with small black and whitish spots. Spinous dorsal with two long black ocelli on membrane between first and third spine. Upper part of fin with black dots, larger and more elongate or drawn out into rather broad lines on caudal. Eye red. Length 152 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Ceram (Wahai); Ambon; New Guinea. — Red Sea, Zanzibar, Madagascar, Mauritius, Cargados Carajos, Siam, Japan, China.

2. Solenostomus paradoxus (Pall.). [Fig. 14, p. 29].

Fistularia paradoxa Pallas. Spicil. Zool. VIII. 1870, p. 32.
Fistularia paradoxa Bloch, Schneider, Syst. Ichth. 1801, p. 114.
Solenostomus paradoxus Lacépède, Hist. nat. Poiss. V. 1803, p. 361.
Solenostoma paradoxum Bleeker, Nat. Tijdschr. Ned. Indië VI. 1854, p. 506 (nec *Solenostoma paradoxum* Blkr. 1852 and 1853).
Solenostoma brachyurus Bleeker, Ibid. VIII. 1855, p. 433.
Solenostomus paradoxus Kaup, Cat. Lophobranch. Fish London 1856, p. 2 (pro parte).
Solenichthys brachyurus Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 273.
Solenichthys paradoxus Bleeker, Ibid. p. 274.
Solenostoma paradoxum Günther, Cat. Brit. Mus. VIII. 1870, p. 152.
Solenostoma brachyurum Günther, l. c.
Solenostomus paradoxus A. Duméril, Hist. nat. Poiss. II. 1870, p. 497.
Solenostomus brachyurus A. Duméril, Ibid. p. 498.
Solenostomatichthys paradoxus Bleeker, Enumération Poiss. de Madagascar in: Recherch. s. l. Faune de Madagascar, Leide, 1875, p. 76. — Verh. Akad. Amsterdam XVIII. 1877—1878, Poiss. d. Maurice p. 17.
Solenostomus paradoxus Jordan & Snyder, Proc. U. S. Nat. Mus. XXIV. 1901, p. 4.
Solenostoma paradoxum Johnstone, Ceylon Pearl Oyster Fisheries, II. 1904, p. 204.

Solenostomus leptosoma Tanaka, Anot. Zool. Japonenses, VII. 1. 1908, p. 29.
Solenostomus paradoxus Jungersen, Danske Vidensk. Selsk. Skrifter, København (7) VIII. 5, 1910, p. 328.
Solenostomus paradoxus Franz, Japan. Knochenfische in: Doflein, Beitr. z. Naturgesch. Ost-Asiens 1910, p. 22.
Solenostomus paradoxus Max Weber, Siboga-Expeditie, Fische, 1913, p. 105.

D. v. 18—22; A. 18—23; P. 24—26; V. 7.

Height in total length 6—$8^1/_2$; head in total length nearly 3—$3^3/_4$. Eye 7—$8^1/_2$; eye in snout (according to size of the fish) about 4—7 times; least height of snout more or less than 6 times in its length. Caudal peduncle comparatively slender; its height about equal to its length. The membrane of the caudal fin beginning at a distance from the 2. dorsal and anal of more than half the length of the base of these fins. In young specimens about equal to that length. Posterior margin of ventrals evenly convex in both sexes. The skin may be provided with scattered, more or less visible dermal prolongations, which villi are branched in some places. Light brownish with irregular orange spots, the centrum of which may be paler. Spinous dorsal with large black blotches on the membrane between the first 3 spines. Other blotches on the fin smaller. Caudal clouded with blackish. Length 165 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Ambon; Ceram. — Zanzibar, Mauritius, Maldives, Gulf of Manaar, Japan.

3. Solenostomus armatus M. Web. [Fig. 15, p. 29].

Solenostomus armatus Max Weber, Siboga-Expeditie, Fische, 1913, p. 103.

D. v. 23; A. 22; P. 24; V. 7.

Height 8 in total length, $5^1/_2$ without caudal. Head $3^1/_3$ in total length, $2^3/_{10}$ without caudal. Eye 10, somewhat less than twice in postorbital part of head. Eye 7 times in snout. Least height of snout 9 times in its length. Dorsal contour of snout obliquely running forwards from front to posterior third of snout, further on getting more and more concave and finally strongly rising to upper border of mouth; before its posterior third on both sides a tricuspidate prominence. From this spot diverge the sharply serrated cristae supraorbitales, both bifurcate behind posterior border of eye into a short median edge and into a serrated lateral one running to the neck. Between the two median edges a high occipital crest with 5 sharp spines extending

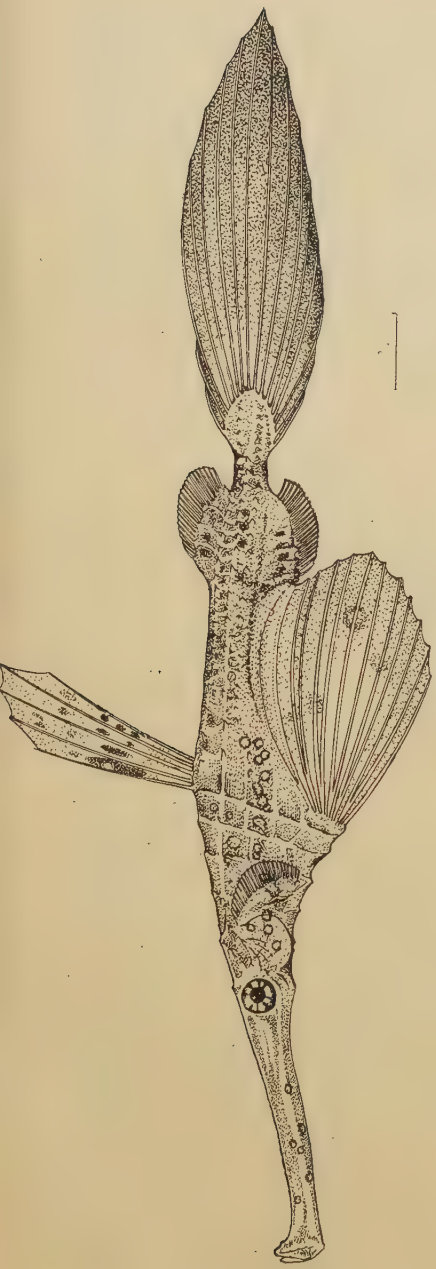

Fig. 14.
Solenostomus paradoxus (Pall.).
n. s. after JORDAN & SNYDER.

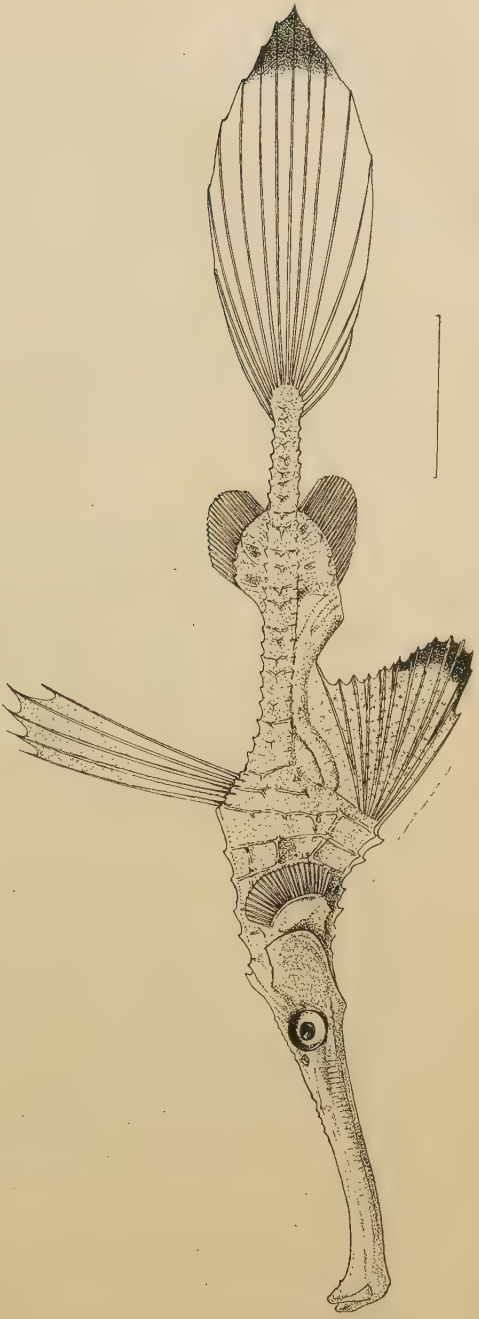

Fig. 15.
Solenostomus armatus M. Web.
× 2.2.

to first dorsal. Below eye an edge with small spines getting higher and more crowded posteriorly. Caudal peduncle slender, very low, its height about thrice in its length. The membrane of the caudal beginning at a distance from the 2. dorsal and anal, which is longer than the base of both fins. Posterior margin of ventrals deeply concave near abdomen in female. A series of sharp curved spines beginning behind head on both sides along upper and lower surface of body and along its lateral line. Caudal as long as head. Colour uniform yellowish. Hindmargin of ventrals between their longest rays and caudal at its point blackish. Eyes red. Length 80 mm.

Habitat: Arafura Sea (95 M. bottom muddy)!

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5. Fam. Syngnathidae.

Physoclists. Body elongated, angular or laterally compressed or rounded; tail long; head slender, generally with a produced tube-like snout, with a terminal, oblique mouth, bordered by the small intermaxillaries, maxillaries and mandibles. All these bones withouth teeth as also the vomer, palatines and pterygoids. Posttemporal suturally united to the skull. No supracleithrum; cleithrum firmly united with the transverse processes of the two anterior vertebrae. Of the 4 pterygials the distal parts are fixed between dermal scutes. Pectorals and scapular arch may be wanting. The skin is completely armoured by bony scutes (shields or plates), arranged regularly in series, and forming rings (annuli) round the body, which, with exception of the first, correspond to the vertebrae. Of the vertebrae the three anterior are immovably jointed together. One dorsal (by exception absent) of soft rays only, generally opposite to the minute anal, which usually is present. Caudal small, when absent the tail is more or less prehensile. Pectorals small or wanting; ventrals none. Two nasal openings. Opercular bones present, operculum large. One branchiostegal, distally divided. Four complete lobate gills, pseudobranchiae well developed. Gillopenings reduced to small dorsal apertures, the margin of the gillmembranes being fused with the isthmus and the body.

The male takes charge of the eggs. They are united into a plate loosely attached to the abdominal skin of the male,

or the single eggs are fixed to the skin of the abdomen or to the ventral surface of the tail and isolated in cutaneous cells from their neighbours. The egg-plate is uncovered or the eggs are enclosed in a pouch on the abdomen or on the tail, formed by two folds of the skin, the free borders of which remain at some distance from each other or meet in the median line and may even coalesce. In the last case they open some time after hatching, when the young are released. These folds are reduced after the breeding season or they are permanently closed to a sac with an anterior small opening *(Hippocampus)*. The skin-folds often also contain bony plates derived from the body-rings, or these plates alone form the pouch-folds.

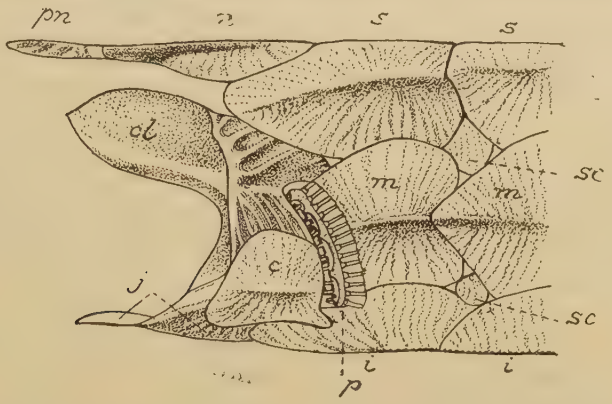

Fig. 16. Dermal skeleton and pectoral arch of *Siphonostoma typhle* L. from outside, *s* superior, *m* median, *i* inferior lateral plates, *sc* scutellum, *pn* praenuchale, *n* nuchale, *cl* cleithrum, *p* pectoral, *j* jugular plates, *c* cover plate. (After JUNGERSEN).

Specialised fishes of small size living in the shore-water of tropical and temperate seas; many species entering fresh water. They are bad swimmers, moving about in a vertical position by undulating movements of the dorsal. Those who are wanting a caudal, are able to bend the end of the tail and to attach themself by it to seaweed or other objects.

Remarks: The discrimination of genera and species is in the first place based on differences in the dermal armour, constituted by bony scutes (shields or plates), arranged into succeeding rings (annuli).

In the praedorsal region each ring is composed of 7 plates:

one unpaired: the ventral plate (scutum abdominale) and 3 paired, the superior, median and inferior lateral plates (scuta lateralia superiora, media et inferiora); in most genera there are small *intermedial* scutes (scutella) between the lateral scutes. Only the first or scapular ring of DUNCKER is more complicated. The first ring consists of the "Skapularschild" of DUNCKER = "dermal part of the clavicle and the coverplate" of JUNGERSEN and DUNCKER's "Axillarschild" = JUNGERSEN's median lateral plate of the second ring and in the third place of JUNGERSEN's "jugular plate" = "Infrascapulare" of DUNCKER. The *praenuchal* plate (shield), between the occipital crest of the skull and the first spinous process and the *nuchal* plate (shield) between the spinous process of the first and second vertebrae are possibly modified interspinous bones.

The scapular ring of DUNCKER consists, according to JUNGERSEN, in reality of the elements of two rings. But as the second ring, that behind the pectorals, is *the first ring of typical composition*, we follow DUNCKER and count both, for convenience sake, as the first ring of the trunk (cfr. Fig. 16).

The postdorsal or tail rings contain only the paired scuta lateralia superiora et inferiora.

The scuta of the same name are antero-posteriorly linked together by a kind of articulation. Each scutum (shield) is provided with a median longitudinal keel, and as the keels of the succeeding scuta fit together, the succeeding keels produce the longitudinal cristae of trunk and tail, the number of which corresponds with the arrangement of scutes in trunk and tail. We distinguish therefore on the trunk the unpaired crista abdominalis trunci, which terminates on the last or forelast trunk-ring, the paired cristae laterales superiores, mediae et inferiores trunci and on the tail the cristae laterales superiores et inferiores caudae. In the subdorsal region, where generally the last trunk-rings and the foremost tail-rings carry the dorsal fin, the paired keels of trunk and tail are continuous or they are in different way discontinuous. There exist, according to DUNCKER, the following modifications:

I. Superior cristae of trunk and tail continuous.

1. Inferior cristae of trunk and tail discontinuous. Median cristae of trunk and inferior cristae of tail continuous . . . fig. 17, n°. 1.

2. Inferior cristae of trunk and tail continuous.

a. Posterior end of median cristae of trunk deflected and sub-continuous with inferior cristae of tail. . . . . fig. 17, n°. 2.

b. Median cristae of trunk rectilinear, ending free. . . . . fig. 17, n°. 3.

c. Median cristae of trunk rising hindwards behind dorsal and reaching the superior cristae of the tail or nearly so. fig. 17, n°. 4.

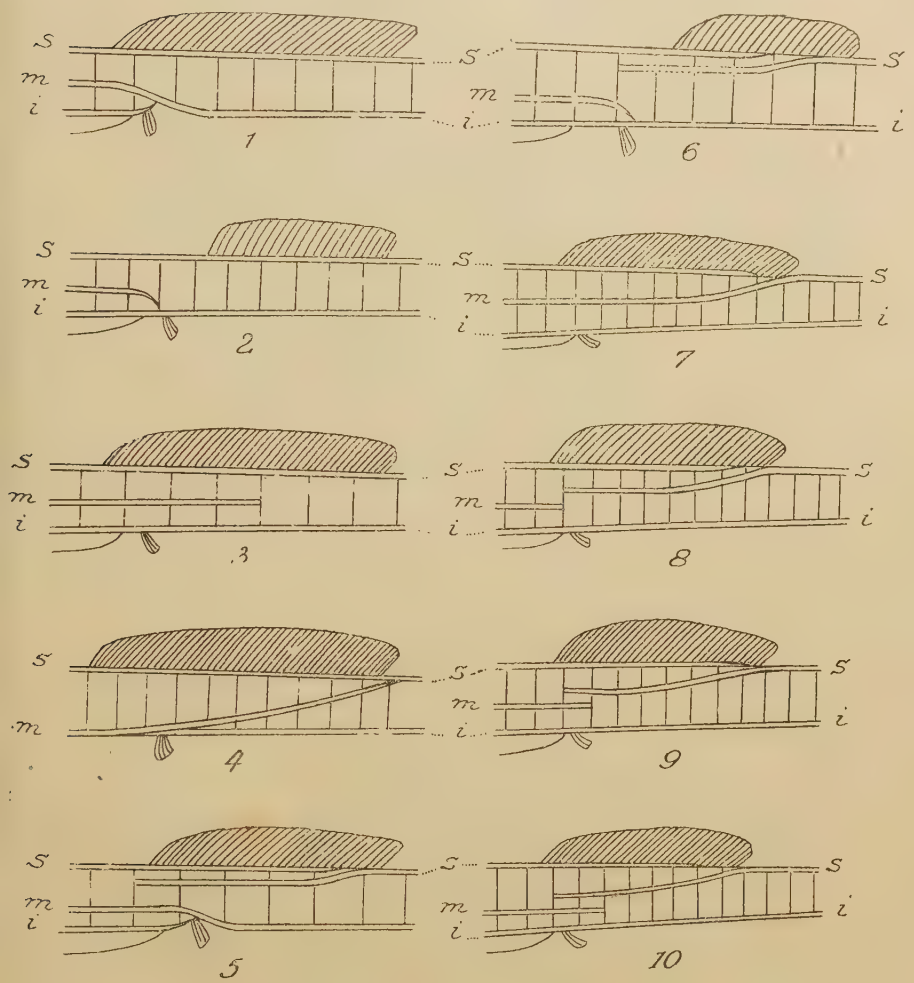

Fig. 17. Arrangement of superior (*s*), inferior (*i*) and median (*m*) cristae in subdorsal region of Syngnathidae. For explanation see text.

II. Superior cristae of trunk and tail discontinuous.

1. Inferior cristae of trunk and tail discontinuous. Median cristae of trunk and inferior cristae of tail continuous . . . fig. 17, n°. 5.

2. Inferior cristae of trunk and tail continuous.

a. Posterior end of median cristae of trunk deflected and sub-continuous with inferior cristae of tail . . . . . fig. 17, n°. 6.

b. Median cristae of trunk and superior cristae of tail:

α. continuous. . . . . fig. 17, n°. 7.

β. subcontinuous. — Subdorsal interruption of the superior and median cristae:

β′ incomplete . . . . . fig. 17, n°. 8.

β″ complete . . . . . fig. 17, n°. 9.

β‴ excessive . . . . . fig. 17, n°. 10.

Of much taxonomical value are the modifications how the parental care is executed in the males. We have indicated above that the eggs are carried open or in pouches of different construction on the ventral surface of the abdomen (*Gastrophori* DUNCKER) or subcaudal (*Urophori* DUNCKER).

DUMÉRIL (Hist. nat. Poissons 1870, p. 585) has already expressed the opinion, that "le véritable classement" of the *Syngnathidae* must be based on the brood organ of the male; GÜNTHER (Cat. Brit. Mus. VIII, 1870, p. 135) made use of it in his "Synopsis of Genera", but DUNCKER (Mitt. a. d. naturh. Mus. Hamburg 1912 and 1915) made a profound study of this organ and gave an arrangement of the *Syngnathidae* essentially corresponding with the groups higher than genera in the following:

Synopsis of the indo-australian genera of Syngnathidae principally based on the brood organ in the male.

I. Brood organ abdominal (*Gastrophori* Duncker).

A. Eggs attached to and isolated by the skin of the abdomen, open, not protected by lateral cutaneous folds or bony plates (*Gastrotokeina* Duncker).

1. No caudal, tail prehensile; trunk strongly depressed. *Syngnathoides* p. 39.

2. Caudal large, tail not prehensile; trunk compressed. *Acanthognathus p.* 41.

B. Eggs attached to and isolated by the skin of the abdomen, laterally protected by osseous plates or cutaneous folds only, which coalesce during breeding (*Doryrhamphina* Duncker).

1. Superior cristae of trunk and tail continuous. Operculum with a complete keel. Anus behind middle of length . . . . . *Choeroichthys* p. 60.

2. Superior cristae of trunk and tail discontinuous.
   a. Operculum without a keel. Anus in or before middle of length.
      α. Dorsal 42—60. Subdorsal rings 4—5 + 8—9. Snout distinctly separated from forehead. . . *Coelonotus* p. 56.
      β. Dorsal 64—68. Subdorsal rings 11—12 + 4. Upper profile of snout gradually continued in that of forehead . . . . . *Belonichthys* p. 59.
   b. Operculum with a complete or basal incomplete keel.
      α. Trunkrings more numerous than tailrings. Anus behind middle of length. Dorsal for its greatest part inserted on trunk; caudal longer than half length of head. . . . . *Doryrhamphus* p. 63.
      β. Trunkrings equal to or generally less numerous than tailrings. Dorsal for its greatest part inserted on tail; caudal equal to or shorter than postorbital part of head.
         αα. Anus behind middle of length. Number of trunkrings equal to or somewhat less than that of tailrings. Snout longer than remaining part of head . . . . . *Microphis* p. 43.
         ββ. Anus generally before middle of length. Number of trunkrings less than that of tailrings. Snout shorter or only slightly longer than remaining part of head . . . *Doryichthys* p. 49.

II. Brood organ subcaudal (*Urophori* Duncker).
   A. Eggs attached to and isolated by the skin of the ventral surface of the anterior part of the tail, open, not protected by lateral cutaneous folds or bony plates (*Solenognathina* Duncker).
      1. Tail prehensile. Dorsal situated on tail only. Operculum without keel but with smooth or serrated radial ridges . . . . . *Solegnathus* p. 65.
   B. Eggs attached to and isolated by the skin of the ventral surface of the anterior part of the tail; laterally protected by osseous plates or cutaneous folds only, which coalesce during breeding. (*Syngnathina* Duncker).
      1. Dorsal, anal and pectorals absent . . . . . *Penetopteryx* p. 95.
      2. Pectorals absent . . . . . *Nannocampus* p. 94.
      3. Dorsal, anal and pectorals present.
         a. Caudal fin none.

α. Body depressed or subcylindrical. Tail filiform but not prehensile. Head not elevated, without spines. *Stigmatophora* p. 97.

β. Body compressed. Tail prehensile. Head compressed with a broad crest on occiput and neck, provided with strong spines . . . . . *Haliichthys* p. 105.

b. Caudal fin present.

α. Superior cristae of trunk and tail continuous. . . . *Ichthyocampus* p. 90.

β. Superior cristae of trunk and tail discontinuous.

aa. Opercular keel rectilinear, complete or incomplete. Base of dorsal not elevated.

αα. Inferior cristae of trunk and tail continuous; median cristae of trunk and inferior cristae of tail discontinuous.

1. Upper profile of snout evenly continued in that of forehead; orbits not prominent . . *Syngnathus* p. 77.

2. Snout forming an angle with the orbital part of the head, which is prominent . . . *Corythoichthys* p. 68.

ββ. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. Snout forming no angle with orbital part of head . . . . . *Micrognathus* p. 74.

bb. Opercular keel convex, bent upwards to gill-opening, with radial lines. Base of dorsal elevated. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous.

1. Edges of shields spinous; dorsal profile of snout and head spinous. Orbital part of head strongly prominent and sharply separated from snout. *Halicampus* p. 102.

2. All the edges and ridges of head smooth.

a. Orbits prominent. Snout equal to postorbital part of head, with a median serrated keel. *Trachyrhamphus* p. 98.

b. Orbits not prominent. Snout in indo-australian species equal to or longer than remaining part of head, without serrated keel . . . . . *Vozia* p. 100.

C. Brood organ a subcaudal permanent egg pouch, permanently closed by median coalescence of the lateral cutaneous folds and provided with a cranial opening, which can be closed by a circular muscle (*Hippocampina* Duncker).

1. Tail prehensile. Longitudinal axis of head forming a right angle with axis of trunk. Praenuchal shield surmounted by a coronet . . . . . *Hippocampus* p. 106.

To facilitate the discrimination of genera in case one can dispose only of female or male specimens without a brood organ, we give the following artificial key in which nearly no use is made of the egg-bearing organ.

Artificial key to the indo-australian genera of Syngnathidae.

I. Caudal fin present.

1. Dorsal, anal and pectorals absent . . . . . *Penetopteryx* p. 95.
2. Pectorals absent . . . . . *Nannocampus* p. 94.
3. Dorsal, anal and pectorals present.

A. Superior cristae of trunk and tail discontinuous.

a. Operculum without a keel; inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous.

1. Dorsal 21—25. Subdorsal rings 1 + 3—4. Edges of shields with a pronounced posterior spine. Upper profile of snout scarcely separated from forehead . . . . . *Acanthognathus* p. 41.
2. Dorsal 42—60. Subdorsal rings 4—5 + 8—9. Edges of shields indistinct, rounded. Snout distinctly separated from forehead. . . . . *Coelonotus* p. 56.
3. Dorsal 64—68. Subdorsal rings 11—12 + 4. Edges of shields rounded, smooth. Upper profile of snout gradually continued in that of forehead . . . . . *Belonichthys* p. 59.

b. Operculum with a complete or basal, incomplete keel. Inferior cristae of trunk and tail continuous or discontinuous; median cristae of trunk and inferior cristae of tail continuous or discontinuous.

aa. Opercular keel rectilinear. Base of dorsal not elevated.

α. Trunkrings more numerous than tailrings. Dorsal for its greatest part inserted on trunk; caudal longer than half length of head. . . . . *Doryrhamphus* p. 63.

β. Trunkrings equal to or generally less numerous than tailrings. Dorsal for its greatest part inserted on tail; caudal equal to or shorter than postorbital part of head.

αα. Egg-pouch abdominal.

1. Anus behind middle of length. Number of trunkrings equal to or somewhat less than that of tailrings. Snout longer than remaining part of head. . . . . *Microphis* p. 43.

2. Anus generally before middle of length. Number of trunkrings less than that of tailrings. Snout shorter or only slightly longer than remaining part of head. . . . *Doryichthys* p. 49.

ββ. Egg-pouch subcaudal.

1. Inferior cristae of trunk and tail continuous; median cristae of trunk and inferior cristae of tail discontinuous.

a. Upper profile of snout evenly continued in that of forehead; orbits not prominent. *Syngnathus* p. 77.

b. Snout forming an angle with the orbital part of the head, which is prominent. . *Corythoichthys* p. 68.

2. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. Snout forming no angle with orbital part of head. . . . *Micrognathus* p. 74.

bb. Opercular keel convex, bent upwards to gill-opening, with radial lines. Base of dorsal elevated. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous.

1. Edges of shields spinous; dorsal profile of snout and head spinous. Orbital part of head strongly prominent and sharply separated from snout. . . . . *Halicampus* p. 102.

2. All the edges and ridges of head smooth.

a. Orbits prominent. Snout equal to postorbital part of head, with a median serrated keel. *Trachyrhamphus* p. 98.

b. Orbits not prominent. Snout in indo-australian species equal to or longer than remaining part of head, without serrated keel. . . . . *Yozia* p. 100.

B. Superior cristae of trunk and tail continuous.

1. Egg-pouch abdominal. Operculum with a complete, longitudinal keel. Anus behind middle of length; trunkrings less than 25 . . . . . *Choeroichthys* p. 60.

2. Egg-pouch subcaudal. Operculum with or without a complete or incomplete longitudinal keel. Anus before middle of length; trunkrings about 30—50. . . . . *Ichthyocampus* p. 90.

II. Caudal fin none, tail in most cases prehensile.
1. Body depressed or subcylindrical.
a. Snout very slender, twice as long as remaining part of head. Praenuchal and two nuchal shields present. Tail filiform but not prehensile . . . . . *Stigmatophora* p. 97.
b. Snout rather stout, nearly twice the length of post-orbital part of head. No praenuchal shield. Tail prehensile . . . . . *Syngnathoides* p. 39.
2. Body compressed, not or scarcely dilated. Tail prehensile.
a. Base of dorsal not elevated; dorsal situated on tail only. No cutaneous appendages. Operculum without keel, but with smooth or serrated radial ridges. . *Solegnathus* p. 65.
b. Base of dorsal elevated; dorsal situated on trunk and tail. Operculum with convex keel bent upwards to branchial opening.
1. Longitudinal axis of head and trunk nearly in the same plane. Praenuchal shield without a coronet; numerous long cutaneous appendages . . *Haliichthys* p. 105.
2. Longitudinal axis of head forming a right angle with axis of trunk. Praenuchal shield surmounted by a coronet; cutaneous appendages generally absent . . . . . *Hippocampus* p. 106.

1. Syngnathoides Bleeker [1]).

(Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 231 and 259. — Verh. Batav. Genootsch. XXV. 1853, Bijdr. Kennis Troskieuwige visschen, p. 5, 9 and 12). *Gastrotokeus* Kaup, Arch. f. Naturgesch. XIX. 1, 1853, p. 230 and Cat. Lophobranchiate Fish, London 1856, p. 18.

Body elongate, depressed, tetragonal; with narrow dorsal surface. The ventral surface much broadened, limited by the median lateral cristae (lateral lines) and in the male covered by soft skin in which the eggs are embedded, uncovered by cutaneous folds or scutal plates. Tail shorter than head and body, hexagonal in its subdorsal part, furtheron quadrangular, rapidly tapering, without caudal and prehensile. Superior cristae of trunk and tail as also the inferior cristae continuous, which are not conspicuous on the trunk. Posterior end of median cristae (lateral lines) bent upwards and reaching the superior cristae behind dorsal or nearly so (Fig. 17, 4). No

1) We have shown (Zoolog. Mededeel. Museum Leiden. VI. 1. 1921, p. 67), that *Syngnathoides* Bleeker 1851 has precedence before *Gasterotokeus* Kaup 1853.

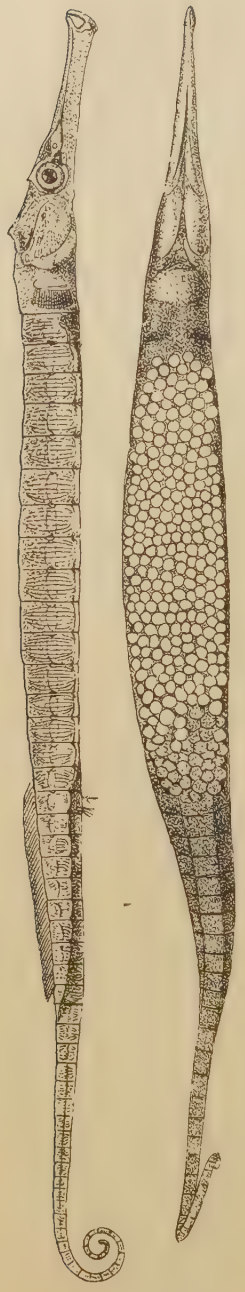

Fig. 18. *Syngnathoides biaculeatus* (Bl.). Male with eggs n. s.

intermedial scutes (scutella). Praenuchal plate wanting; therefore between occiput and first ring an unprotected surface of skin. Two nuchal plates present; operculum without keel.

Distribution that of the single species known.

1. Syngnathoides biaculeatus (Bl.). [Fig. 18, p. 40].

Syngnathus biaculeatus Bloch, Ausländische Fische I. 1875, p. 10.

Syngnathus tetragonus Thunberg, Beskrifn. på *Syngnathus tetragonus*, en obekandt fisk ifrån Java in: Physiogr. Selsk. Handlgr. Lund, I, 4. 1776—1786, p. 301 [1]).

Syngnathus tetragonus Linné-Gmelin, I. 1788, p. 1453.

Syngnathus biaculeatus Bloch, Schneider, Syst. Ichth. 1801, p. 514.

Syngnathus biaculeatus Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1369.

Syngnathoides blochii Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 231 and 259.

Solegnathus blochii Bleeker, Verhand. Batav. Genootsch. XXV. 1853, Bijdr. Kennis Troskieuwige Visschen, p. 13, 24.

Gastrotokeus biaculeatus Peters, Übers. d. in Mossambique beobachteten Fische, Arch. f. Naturgesch. I. 1855, p. 277. — Übers. d. in Mossambique beobacht. Seefische, Sitzber. Akad. Berlin, 1855, p. 465.

Gastrotokeus biaculeatus Kaup, Cat. Lophobr. Fish, 1856, p. 19.

1) Thunberg's article was published as N°. 30 in the first volume of the Physiograph. Selsk. Handlingar which was edited between 1776 and 1786. Prof. E. Lönnberg of Stockholm was kind enough to inform us, that part 4 of the first volume contained the articles 28—33 and was ready May 1786. It is therefore probable, that Thunberg's article (N°. 30) appeared already in 1785 or even earlier and that therefore his name *S. tetragonus* is prior to *S. biaculeatus* of Bloch, as one is inclined to suppose in accordance with the nomenclature and synonymy of Linné-Gmelin. But this can not be proved as, according to the kind information of the present secretary of the Physiographic Society of Lund, the "Protocols" of the Society contain nothing about the article of Thunberg.

Gastrotokeus biaculeatus Bleeker, Nat. Tijdschr. Ned. Indië XV. 1858, p. 204.
Gastrotokeus biaculeatus Duméril, Hist. nat. Poissons II. 1870, p. 528.
Gastrotokeus biaculeatus Günther. Cat. Brit. Mus. VIII. 1870, p. 194.
Gastrotokeus biaculeatus Klunzinger, Abhandl. zool.-bot. Gesellsch. Wien XXI. 1871, p. 653.
Gastrotokeus biaculeatus Day, Fishes of India 4°, 1878—1888, p. 681.
Gastrotokeus biaculeatus Duncker, Spolia Zeylanica vol. VII. Prt. XXV. 1910, p. 25. — Mitt. a. d. naturh. Mus. Hamburg, XXXII. 1915, p. 38.
Syngnathoides biaculeatus Mc Culloch, Check-List of the fish of New South Wales 1919, p. 27.

D. 37—50; A. 4—6; P. 20—23; Rings 15—17 + 40—54; subdorsal rings 1—2 + 8—10.

Shields transversally striated, wanting totally in rings of posterior half or third of tail and ventrally in some of the preceding rings. Skin often with numerous longer or shorter branched filaments forming at the chin a pair of branched barbels. Operculum radially striated without keel. Origin of dorsal nearly opposite to vent. Pale green or brown, dark brown spots ventrally along the median cristae of the trunk. Length 260 mm. Females somewhat shorter than males.

Fig. 19. *Syngnathoides biaculeatus* (Bl.) Head of a specimen of 151 mm. × 1½.

Habitat: Singapore; Sumatra; Pulu Weh!; Nias!; Banka; Bintang!; Borneo (Balikpapan!; East coast!); Java; Bawean; Celebes (Minahassa!, Menado, Makassar!); Saleyer!; Island Biaru!; Sawan; Island Siau!; Batjan!; Buru; Manipa!; Ambon!; Nusa Laut!; Saparua; Ceram!; Banda; Ternate!; Halmahera!; Waigeu!; Schouten Islands; Misore; West Doffer!; Goram; New Guinea!; Aru!; Flores!; Adonara!; Solor; Samau!; Sumba!. — Red Sea, Zanzibar, Mossambique, Madagascar, Seychelles, Malgassy Islands, Gulf of Manaar, British India, Andamans, Ceylon, Pinang, Malayan Peninsula, Siam, Philippines, Southern China, Japan, Australia, Pacific Islands to Samoa. Reaching therefore from East Africa to Samoa, northwards to Riu Kiu Islands, southwards to South Australia.

Marine, living in shallow water; a bad swimmer, probably attached to marine plants.

2. Acanthognathus Duncker.

(Duncker, Mitt. a. d. Naturhist. Museum Hamburg, 1912, p. 228).
Corythoichthys Kaup, Cat. Lophobranchiate Fish, 1856, p. 25 (p. p.).

Fig. 20. *Acanthognathus dactyliophorus* (Blkr.) × 1 1/3.

Microphis Duméril, Hist. nat. Poissons II. 1870, p. 588.
Doryichthys Günther, Cat. Brit. Mus. VIII. 1870, p. 179 — Regan, Revue suisse de Zoologie 1903, p. 413.

Body much elongate, heptagonal, the abdominal crista being flattened. Eggs attached to the skin of the abdomen, in which they are embedded, incompletely isolated from each other and uncovered by cutaneous folds or scutal plates. Tail rather short, tetragonal. Anus behind middle of length. Superior and inferior cristae of trunk and tail discontinuous. Median cristae of trunk and inferior cristae of tail continuous. Greatest part of short dorsal above caudal rings; anal and pectorals present; caudal extensive. The edge of each ring terminates in a spine. Intermedial scutes (scutella) present, as also the praenuchal and two nuchal plates.

Distribution: Mauritius, Indo-australian Archipelago, Pelew Islands and New Caledonia.

1. Acanthognathus dactyliophorus (Blkr.)

[Fig. 20, p. 42].

Syngnathus dactyliophorus Bleeker, Nat. Tijdschr. Ned. Ind. IV. 1853, p. 506. — Verh. Batav. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen p. 16.
Corythröichthys dactyliophorus Kaup, Cat. Lophobr. Fish, 1856, p. 28.
Microphis dactyliophorus Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 8. Bijdr. vischfauna Sumatra p. 72. — Ned. Tijdschr. Dierk. II. 1865, p. 273.
Microphis dactyliophorus Duméril, Hist. nat. Poiss. II. 1870, p. 592.
Doryichthys dactyliophorus Günther, Cat. Brit. Mus. VIII. 1870, p. 186. — Fische d. Südsee III. 1909—1910, p. 433.
Acanthognathus dactylophorus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXIX. 1912, p. 228. — Ibid. XXXII. 1915, p. 41.

D. 21—26; A. 4; P. 20—21; rings 16—18 + 19—21; subdorsal rings 1 + 3—4.

Shields somewhat granulated. The edges of the single shields terminate in a prominent spine. Operculum granulated, without keel, but with an oblique raised line. Head more than 4 to 5 times in length. Tail somewhat shorter than trunk. Snout thin, rounded, about thrice longer than postorbital part of head, about twice the length of the remaining part of the head. Vent below the origin of the dorsal fin, nearer to the end of the tail than to the gillopenings. Caudal long, about twice longer than postorbital part of head. Yellow, head and body encircled by blackish rings; about 18—20 equidistant ones on trunk and tail, 7—9 on head. Length 161 mm. [A specimen of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Island Onrust near Java; Ambon; New Guinea. — Pelew Islands, Marshall Islands, New Caledonia.

In sea, shore-water and on reefs.

3. **Microphis** (Kaup) Duncker.

(DUNCKER, Spolia Zeylanica Vol. VII. prt. XXV. 1910, p. 26. — Mitt. a. d. naturh. Mus. Hamburg, XXIX. 1912, p. 229).

Doryichthys Kaup, Cat. Lophobr. Fish, 1856, p. 56 (p.p. et plur. auctores).

Microphis Kaup, Cat. Lophobr. Fish, 1856, p. 63 p.p.

Doryrhamphus Jordan & Evermann, Fishes North- and Middle-America 1896, p. 773, p.p.

Superior cristae of trunk and tail discontinuous, inferior cristae of trunk and tail discontinuous or continuous (fig. 17, 5 and 8—10), median (lateral) cristae of trunk and inferior cristae of tail continuous or not. Keels of the shields of the rings more or less serrated, generally terminating in a free spine posteriorly. Intermedial shields (scutella) present, as also a praenuchal and 2

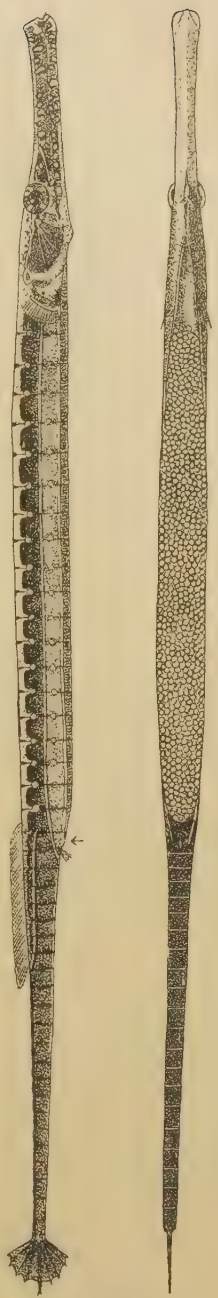

Fig. 21. *Microphis brachyurus* (Blkr.). ♂ n. s.

nuchal shields. Operculum with a complete longitudinal keel and radiating ridges. Snout longer than remaining part of head. Dorsal rather long, with more than 30 rays, opposite to vent, situated above at least 7 rings belonging for their largest part to the tail; anal behind middle of length, pectorals present, caudal well developed, generally the middle ray prolonged. Eggs small, numerous, isolated in open cells belonging to the swollen skin of the somewhat dilated *abdomen* of the male; they are not covered by cutaneous folds but laterally protected by ventrally *diverging* plates belonging to the lower lateral edges of the trunk.

Distribution: Living in fresh- and brackish water connected with tropical seas.

Key to the indo-australian species of Microphis.

I. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous (fig. 17, n°. 5).
   a. Snout somewhat longer than twice length of postorbital part of head; head $4^1/_2$—5 times in length. *M. brachyurus* p. 44.
   b. Snout much shorter than twice length of postorbital part of head; head about 7 times in length . . . . . *M. manadensis* p. 46.

II. Inferior cristae of trunk and tail continuous; median cristae of trunk not continuous with inferior cristae of tail, but subcontinuous with superior cristae of tail (fig. 17, n°. 8, 9, 10).
   a. D. 47—61 . . . . . *M. boaja* p. 47.
   b. D. 65—68 . . . . . *M. heterosoma* p. 48.

1. Microphis brachyurus (Blkr.) [Fig. 21, p. 43].

Syngnathus brachyurus Bleeker, Verh. Bat. Genootsch. XXV. 1853, Troskieuwige Visschen p. 16.
Syngnathus cuncalus Bleeker, l. c. Nalezingen Ichth. fauna van Bengalen en Hindostan p. 162 (nec Buchanan).
Syngnathus brachyurus Bleeker, Nat. Tijdschr. Ned. Indië VIII. 1854, p. 105.
Syngnathus polyucanthus Bleeker, Act. Soc. Sc. Indo-Neerl. I. 1856, Visschen Manado, p. 77.
Doryichthys Hasseltii Kaup, Cat. Lophobr. Fish, 1856, p. 57.
Doryichthys auronitens Kaup, ibid. p. 59.
Doryichthys millepunctatus Kaup, ibid. p. 60.
Microphis brachyurus Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 8. Bijdr. Visschen Sumatra, p. 72.
Microphis cuncalus Bleeker, ibid. (nec Buchanan).
Syngnathus Schlegeli Day, Proc. Zool. Soc. London, 1865, p. 316 (nec Kaup).

Microphis Bleekeri Day, Fishes of Malabar, London, 1865, p. 265.
Microphis Jouani Duméril, Hist. nat. Poiss. II. 1870, p. 592.
Microphis brachyurus Duméril, ibid. p. 595.
Microphis auronitens Duméril, ibid. p. 597.
Microphis Bleekeri Duméril, ibid. p. 599.
Doryichthys brachyurus Günther, Cat. Brit. Mus. VIII. 1870, p. 184.
Doryichthys brachyurus Bleeker, Enumération Poiss. de Madagascar in: Recherch. s. l. Faune de Madagascar, Leide, 1875, p. 75.
Doryichthys Bleekeri Day, Fishes of India 4°, 1878—1888, p. 680.
Microphis brachyurus Jordan & Seale, Fishes of Samoa, 1906, p. 214.
Corythroichthys Bleekeri Seale & Bean, Proc. U. S. Nat. Mus. Wash. XXXIII. 1908, p. 240.
Doryichthys brachyurus Günther, Fische d. Südsee, 1910, p. 433.
Microphis brachyurus Duncker, Spolia Zeylanica, Vol. VII. prt. XXV. 1910, p. 26. — Mitt. a. d. naturh. Mus. Hamburg, XXXII. 1915, p. 45.
Microphis brachyurus Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard Coll. XXVI. No. 7, 1911, p. 264.
Doryrhamphus brachyurus Max Weber, Siboga-Expeditie, Fische 1913, p. 117.
Doryrhamphus brachyurus Sundara Raj, Records Indian Museum XII, prt. VI, 1916, p. 269.

D. 36—48; A. 3—4; P. 18—23; Rings 19—22 + 20—24; subdorsal rings 1—3 + 6—9.

Much elongated. Shields transversally striated, their keels serrated and terminating in a spine, most conspicuous in young, becoming obsolete with age. This is also the case with the edges on the head. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. Operculum with complete longitudinal keel and up to 9 (generally 2—4) radiating ridges below it. Head $4^1/_4$—5; tail without caudal shorter than trunk; snout about $2^1/_3$ times the length of the postorbital part of the head, about 1.5 or more in length of head. Vent below or somewhat behind origin of dorsal. Caudal shorter than postorbital part of head, its middle ray enlarged and somewhat elongate. Alcohol-specimens dark brown, lighter below; trunk and root of tail dotted with minute white points. Operculum and anterior part of trunk with black spots. A dark diffuse lateral band from snout to tail. Length 225 mm. [Specimens of *Doryichthys polyacanthus* Blkr. and of *Doryichthys brachyurus* Blkr. from BLEEKER's collection in the Leiden Museum seen by us].

Nom. indig.: tuvung tuvung and ĕnai boe manå (Simalur, Tapah); Sili (Javan.); Kilih buaja (Malay).

Habitat: Sumatra (Tandjong); Simalur!; Nias (Lŏlŏwau!); Java (Batavia!, Lebak, Bantam, Priaman, Tjilatjap!, Palabuan

ratu!, Dirk de Vries Bay!); Lombok!; Flores! (River Konga!, Endeh!); Celebes (Makassar!, Menado, river Boni!, Pampanuwa on river Tjenrana!, Balangnipa on Tanga river!); Buru (Kajeli!); Ceram (Kairatu!); Ambon!; Ternate; Batjan!; Aru Islands, fresh and brackish water!; North New Guinea (river Klipong!, Mbai river!, Tateh river!). — Indo-Pacific, reaching from East Africa, Madagascar, Mascarenes, British India, Ceylon, Cochinchina, Japan, Philippines, Caroline Islands, Bismarck Archipelago, New Caledonia!, Fidji-, Tonga-, Samoa-, Cook- and Society Islands.

In fresh water of rivers and brackish and salt water of their estuaries.

2. **Microphis manadensis** (Blkr.)

Syngnathus manadensis Bleeker, Act. Soc. Sc. Indo-Neerl. I. 1856, Vischsoorten van Manado en Makassar, p. 78.
Doryichthys manadensis Bleeker, l. c. VIII. 1860, 8. Bijdr. vischfauna Sumatra p. 72. — Ibid. 13. Bijdr. vischfauna Celebes p. 13.
Doryichthys Bernsteini Bleeker, Arch. Néerl. Sc. Nat. II. 1867, p. 398.
Microphis Jagorii Peters, Monatsber. Akad. Berlin, April 1868, p. 280.
Microphis Jagorii Duméril, Hist. nat. Poiss. II. 1870, p. 594.
Microphis Bernsteini Duméril, ibid. p. 594.
Microphis manadensis Duméril, ibid. p. 595.
Doryichthys manadensis Günther, Cat. Brit. Mus. VIII. 1870, p. 184.
Doryichthys Bernsteini Max Weber, Nova Guinea V. Zool. II. Fische 1908, p. 229.
Doryichthys stictorhynchus Ogilby, Mem. Queensl. Mus. I. 1912, p. 34.
Microphis manadensis Duncker, Mitt. a. d. naturh. Mus. Hamburg, XXXII, 1915, p. 47.

D. 35—42; A. 3—4; P. 18—20; Rings 20—22 + 24—27; subdorsal rings 2—3 + 6—7.

Much elongate. Shields transversely striated, their keels slightly elevated and only in the young minutely serrated; without terminal spine. Edges on head smooth. Inferior cristae of trunk and tail discontinuous, median cristae of trunk and inferior cristae of tail continuous. Operculum with complete longitudinal keel and up to 5 radiating ridges below it. Head about 7 times in length, not much longer than dorsal; tail without caudal equal to or slightly shorter than trunk; snout one and a half times the length of the postorbital part of head or somewhat longer and equal to or not much longer than half the length of the head. Vent somewhat behind origin of dorsal. Caudal equal to or somewhat shorter than postorbital part of head. Brownish, a narrow dark longitudinal band from snout to hindmargin of operculum or somewhat farther. Length 212 mm. [Specimens of *Doryichthys manadensis*

Blkr. and of *Doryichthys Bernsteini* Blkr. from BLEEKER's collection in the Leiden Museum seen by us].

Habitat: North Borneo; Celebes (Menado, Makassar); Ambon, in fresh water!; Halmaheira; Dutch North New Guinea (Tanah Merah Bay!, river Mamapiri!); German New Guinea. — Island Samar, Queensland (Moreton Bay).

Living in fresh and brackish water of rivers and their estuaries.

3. Microphis boaja (Blkr.).

Syngnathus boaja Bleeker, Nat. Tijdschr. Ned. Indië I. 1851, p. 16.
Syngnathus boaja Verh. Batav. Genootsch. XXV. 1853, Bijdr. Troskieuwige visschen p. 14.
Doryichthys spinosus Kaup, Cat. Lophobr. Fish, 1856, p. 57.
Microphis boaja Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 8. Bijdr. visch-fauna Sumatra, p. 63.
Microphis boaja Duméril, Hist. nat. Poissons II. 1870, p. 593.
Doryichthys boaja Günther, Cat. Brit. Mus. VIII. 1870, p. 180.
Doryichthys boaja Bleeker, Ned. Tijdschr. Dierk. IV. 1873, p. 126.
Syngnathus Jullieni Sauvage, Revue et Mag. de Zool. (3) II. 1874, p. 338.
Doryichthys boaja Steindachner, Sitzber. Akad. Wien LXXXIII. 1881, p. 210.
Syngnathus zonatus Karoli, Termeszetrajzi Füzetek V. 1882, p. 39.
Dorichthys boaja Volz, Zool. Jahrb. Abt. System. XIX. 1903, p. 411.
Dorichthys boaja Duncker, Mitt. a. d. naturh. Mus. Hamburg XXI. 1904, p. 188.
Microphis boaja Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 47.

D. 47—61; A. 3—5; P. 23—27; Rings 21—24 + 34—40; subdorsal rings 2—5 + 6—7.

Much elongate. Shields transversely striate, their edges not serrated but terminating in a spine; the edges on the head smooth. Inferior cristae of trunk and tail continuous; median cristae of trunk and superior cristae of tail subcontinuous, generally completely interrupted on the last ring of the trunk (fig. 17, n°. 8). Operculum with a complete longitudinal keel and some radiating ridges below it. Head $4^3/_4$—$5^1/_2$ in length; tail longer than trunk; snout long, compressed, more or less than twice the length of the remaining part of the head. Caudal shorter than postorbital part of head. Greenish, yellowish below, tail getting blackish posteriorly; on snout and vertex irregular black patches; on the trunk and on the anterior part of the tail vertical bands corresponding with the shields, silvery — at least in their front- and hindborder — in preserved specimens, blue in life. Length 430 mm. [A specimen of BLEEKER's collection seen by us].

Habitat: Sumatra (Palembang in river Musi, Lematan Enim, river Bantung, Lake Sialong Lotong); Java; Borneo (Sintang![1]), Banjermassin, Pontianak, Singkawang, Sambas, in rivers; Sarawak, Sebruang); Celebes (Makassar!). — Malayan Peninsula, Siam (Bangkok), Cochinchina, China, Formosa.

4. Microphis heterosoma (Blkr.).

Syngnathus heterosoma Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 441.
Syngnathus heterosoma Bleeker, Verh. Batav. Genootsch. XXV. 1853, Troskieuwige Visschen, p. 15.
Syngnathus heterosoma Kaup, Cat. Lophobr. Fish, 1856, p. 62.
Microphis heterosoma Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 8. Bijdr. Vischfauna Sumatra, p. 72.
Microphis heterosoma Duméril, Hist. nat. Poissons II. 1870, p. 590.
Doryichthys heterosoma Günther, Cat. Brit. Mus. VIII. 1870, p. 180.
Microphis heterosoma Duncker, Mitt. a. d. naturh. Mus. Hamburg, XXXII. 1915, p. 48.

D. 65—68; A. 4; P. 22—23; Rings 26 + 38; subdorsal rings 6 + 7—8.

Much elongate; in females the 13th to 20th trunkring ventrally inflated. Shields transversely striated, the edges slightly serrated, somewhat behind the middle of their length produced into a spine. Inferior cristae of trunk and tail continuous, median cristae of trunk and superior cristae of tail subcontinuous but they are interrupted on the last ring of the trunk. The median cristae running below the superior cristae of the tail (Fig. 17, n°. 9 and 10). Operculum with a complete longitudinal keel and fine radiating ridges below it. Head 5—5 1/4 in length. Tail longer than trunk. Vent behind the middle of the total length. Snout compressed, about thrice or more than thrice longer than postorbital part of head and more than twice longer than remaining part of head. Caudal minute. Green above, silvery below. Each trunkring laterally with a vertical dark patch in its middle. Caudal blackish. Length 290 mm. [A specimen of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Borneo (Sambas river, river Kapuas); Natuna Islands.

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1) This specimen in the Leiden Museum, was erroneously identified by VAILLANT (Notes Leyden Museum XXIV, p. 14) as "*Microphis heterosoma*" (Blkr.).

4. Doryichthys (Kaup) Duncker.

(Duncker, Spolia Zeylanica Vol. VII. prt. XXV. 1910, p. 27. — Mitt. a. d. naturh. Mus. Hamburg XXIX. 1912, p. 229).

Doryichthys Kaup, Cat. Lophobr. Fish, 1856, p. 56 [p. p. et plur. auctores].

Microphis Kaup, l. c. p. 63.

Superior cristae of trunk and tail discontinuous; inferior cristae of trunk and tail continuous or discontinuous; median cristae of trunk and inferior cristae of tail continuous (fig. 17 n°. 5, 6, 9, 10). Keels of the shields of the rings conspicuous, smooth in the adults, generally serrated in young specimens. Intermedial shields (scutella) present as also a praenuchal and 2 nuchal shields. Operculum with complete longitudinal keel and often with radiating ridges below it. Snout shorter or only slightly longer than remaining part of head. Dorsal medium or long with 24—66 rays, opposite to vent, situated above at least 6 rings, belonging as a rule for their largest part to the tail. Anal generally before middle of length; pectorals present; caudal with or without prolonged rays. Eggs rather large, isolated in open cells, produced by the skin of the *abdomen* in the male; they are entirely covered by broad, *converging*, not coalescent, lateral protective plates, which sometimes have a narrow cutaneous fold along their free margin.

Distribution: in fresh and brackish water of rivers and their estuaries in the indo-pacific region from British India to Samoa and Philippines.

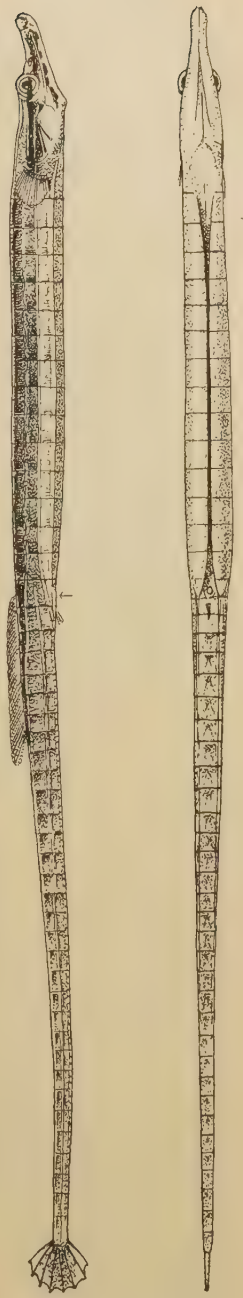

Fig. 22. *Doryichthys retzii* (Blkr.) ♂ × 1½.

Key to the indo-australian species of Doryichthys.

I. Inferior cristae of trunk and tail discontinuous.
  A. Dorsal with more than 50 rays; situated above an equal number of rings of trunk and tail . . *D. spinachioides* p. 50.
  B. Dorsal with less than 50 rays; the subdorsal tail-rings are more numerous than the subdorsal trunk-rings.
    1. Tail shorter than trunk and head. Snout longer than postorbital part of head. Dorsal with 42 rays. . . . . *D. caudocarinatus* p. 51.
    2. Tail longer than trunk and head. Snout equal to or somewhat shorter than postorbital part of head.
      a. Dorsal with 24 rays. . . . . *D. brevidorsalis* p. 51.
      b. Dorsal with 34—40 rays. . . . . *D. retzii* p. 52.

II. Inferior cristae of trunk and tail continuous.
  1. Length of snout much more than remaining part of head, equal to twice the postorbital space . . *D. deokhatoides* p. 53.
  2. Length of snout equal to or less than remaining part of head. . . . . *D. martensi* p. 54.

Doubtful species . . . . . *D. fluviatilis* p. 55.

1. Doryichthys spinachioides Dunck.

Doryichthys spinachioides Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 52.

D. 66; A. 4; P. 19; C. 9; Rings 16 + 27; subdorsal rings 6 + 6.

Edges of body smooth, those of head finely serrated. Snout robust, somewhat shorter than postorbital part of head. Inferior cristae of trunk and tail discontinuous, median cristae of trunk and inferior cristae of tail continuous. Operculum with complete, finely serrated longitudinal keel and fine, smooth radiating ridges below it, the uppermost of them is the most prominent and nearly parallel to the principal keel. Anal before the middle of the length; the caudal, which is of medium size, included. The nuchal crista reaches to the first dorsal intermedial shield; the other intermedial shields (scutella) without keel. Grey above, silvery white below; trunk laterally with a diffuse dark band; operculum silvery. Length of the single specimen known, a female, 82 mm. [After DUNCKER, not seen by us].

Habitat: North New Guinea (Kaiserin Augusta river).

2. Doryichthys caudocarinatus M. Web.

Doryichthys caudocarinatus Max Weber, Nova Guinea V. 2. Süsswasserfische, 1908, p. 229.

Doryichthys caudocarinatus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 51.

D. 42; A. 3; P. 18—19; C. 9; Rings 20 + 28; subdorsal rings 2 + 8.

Body slender, nearly quadrilateral. Shields transversally striated, their keels finely serrated; all the intermedial shields (scutella) of the tail with feeble, narrow longitudinal keels. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. The superior cristae of tail begin below origin of dorsal. Operculum with complete longitudinal keel, below it five radiating ridges all finely serrated. Head 7 times in total length (with caudal). Eye about $6^1/_2$ times in head and about $3^3/_4$ times in snout. Snout slightly longer than postorbital part of head; it is somewhat concave with a median crista reaching the level of frontborder of eye and a lateral crista reaching to the level of posterior border of pupil, below their posterior end a curved edge to neck. Occiput with median crista. Tail slightly shorter than trunk and head. Dorsal lower than height of body. Caudal rounded, as long as postorbital part of head. Brownish, with a dark hue, especially on lower surface of tail and on caudal. Length of the single specimen known (a female) 72 mm.

Habitat: North New Guinea (river Tawarin, fresh water!).

3. Doryichthys brevidorsalis (de Bfrt.)

Doryrhamphus brevidorsalis de Beaufort, Bijdr. tot de Dierkunde, Amsterdam, 19de Afl, 1913, p. 103.

Doryichthys brevidorsalis Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 50.

D. 24; P. 16—17; Rings 16—17 + 28; subdorsal rings 1+5—6.

Body higher than broad; ventral carina in the female rather high. Shields rough with transverse ridges, laterally interrupted in the middle by a rather strong longitudinal keel. Edges of body prominent, finely crenulated, when young very slightly serrated, those of the tail almost smooth. Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. The superior cristae of the tail begin on the last ring of the trunk. Operculum inflated

with a strong median longitudinal complete keel, ventrally radiating from it; a second and sometimes a third longer or shorter strong keel and numerous fine and somewhat arborescent striae. Head $6^2/_5$ to nearly 9 times in total length, 3—4 times in length of head and trunk. Snout, the upper profile of which is slightly concave, about equal to postorbital part of head and more than twice as long as eye, with a median ridge ending before the eyes. Laterally with a straight ridge and above it a second one, which ends curved below eye. Orbital ridges, beginning before nostrils, are continued on the postorbital part of the head, and may be continuous with the superior cristae of the body. A low median, slightly scalloped ridge (crista nuchalis) begins behind the eyes and is continued to the second body-ring. Tail conspicuously longer than trunk and head together; trunk one and a half times in length of tail. Anal before middle of total length. Light brown, a dark band interrupted by white crossbars on the snout runs through the eye and the operculum, where it has white points. It is continued on the body, where it is interrupted by a series of black spots, one on each ring, enclosed in or alternating with white patches. A light ocellus with dark border on each caudal ring along its ventral margin, or the caudal rings have alternating white markings. Length 98 mm.

Habitat: Buru (in a stream near Kajeli, in fresh water!); South New Guinea (Lorentz river, in fresh water!).

4. **Doryichthys retzii** (Blkr.). [Fig. 22, p. 49].

Syngnathus Retzii Bleeker, Act. Soc. Sc. Indo-Neerl. I. 1856, Vischsoorten Menado en Makassar, p. 76.
Microphis caudatus Peters, Monatsber. Akad. Berlin (1868) 1869, p. 276.
Syngnathus Retzii Duméril, Hist. nat. Poissons II. 1870, p. 562.
Microphis caudatus Duméril, l. c. p. 591.
Syngnathus retzii Günther, Cat. Brit. Mus. VIII. 1870, p. 175.
Doryichthys caudatus Günther, l. c. p. 182.
Microphis caudatus Jordan & Seale, Bull. Bur. Fisheries XXV. (1905) 1906, p. 214.
Doryichthys caudatus Günther, Fische d. Südsee Bd. III. 1910, p. 432.
Syngnathus Retzii Max Weber, Siboga-Expeditie, Fische, 1913, p. 111.
Doryrhamphus caudatus Max Weber l. c. p. 116.
Doryichthys Retzii Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 50.

D. 34—40; A. 3—4; P. 16—19; C. 8—10; Rings 16—17 + 28—31; subdorsal rings 1—2 + 7—8.

Shields transversally striated, their edges finely serrated when

young, smooth in adults. Intermedial shields (scutella) of the tail keeled [1]). Inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. The superior cristae of the trunk are continued nearly to the end of dorsal while the superior cristae of the tail are continued to the penultimate ring of the trunk. Operculum with complete longitudinal keel, below it generally 1—2, by exception 3 or none, radiating ridges. Head $7^1/_2$ to more than 10 times in total length. Eye about 5 times in head. Snout as long as or somewhat shorter than postorbital part of head, its upper profile concave. The nuchal crista runs from the middle of the occiput to the first dorsal intermedial shield and is continued somewhat furtheron. Tail conspicuously longer than head and trunk. Length of caudal about equal to postorbital part of head. Caudal with prolonged rays (always, when not mutilated?). Brownish or greenish, generally somewhat darker near the intermedial shields. Length 115 mm. [A specimen of BLEEKER's collection seen by us].

Fig. 23. *Doryichthys retzii* (Blkr.) Caudal fin with prolonged rays; magnified.

Nom. indig. Budi (Menado).

Habitat: Sumatra (Deli); Simalur!; Nias!; Java; Lombok!; Flores!; Sumba!; Savu!; Celebes (river near Kwandang!, river Paloppo!, Menado); Buru (Kajeli!); Obi Major!; Batjan!; Ceram (river Tubah!, brook near Kairatu!); Waigeu (river Wahâi!); New Guinea (North New Guinea: rivers Klipong! and Mbai!, brook Mamâpiri!; South New Guinea: Lorentz river!). — Philippines, Bismarck Archipelago, New Caledonia.

5. Doryichthys deokhatoides (Blkr.).

Syngnathus deokhatoides Bleeker, Verh. Bat. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen, p. 17.
Syngnathus deokhatoides Bleeker, Nat. Tijdschr. Ned. Indië VII. 1854, p. 106.
Doryichthys deokhatoides Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Achtste Bijdr. Vischfauna Sumatra p. 72. — Ibid. 13de Bijdr. Vischfauna Borneo, p. 8.
Microphis deokhatoides Duméril, Hist. nat. Poissons, II. 1870, p. 596.
Doryichthys deokhatoides Günther, Cat. Brit. Mus. VIII. 1870, p. 180.
Dorichthys deokhatoides Karoli, Termeszetrajzi Füzetek, V. 1882, p. 40.
Dorichthys fluviatilis Duncker, Mitt. a. d. naturh. Mus. Hamburg XXI. 1904, p. 188.

1) This is not the case in the specimen of the island Simalur.

Dorichthys deokhatoides Volz, Revue Suisse Zool. XII. 1904, p. 483.
Doryichthys deokhatoides Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 53.

D. 30—35; A. 3—4; P. 18—23; C. 8—10; Rings 17—20 + 31—35; subdorsal rings 1—2 + 4—6.

Much elongate. Height about 16—20 times in total length, higher than broad. Shields transversally striated, the edges finely serrated when young, smooth in adults. Intermedial shields (scutella) smooth. Ventral crista very prominent. Inferior cristae of trunk and tail continuous. Median cristae of trunk and superior cristae of tail subcontinuous, as the end of the median cristae runs somewhat below the superior cristae of the tail and reaches the last trunk-or first tail-ring. Operculum with a prominent complete longitudinal keel, but without radiating ridges. Head $5^1/_2$—$6^1/_2$ times in length. Eye $6^1/_2$—7 times in length of head, about 4 times in snout. Snout about twice the length of the postorbital part of the head or equal to the distance from the frontmargin of the eye to the base of the pectoral. Tail, the caudal included, somewhat longer than trunk and head. Greenish, ventrally darker; laterally on the trunk, at the limits of about the sixth to the fourteenth ring in the superior crista a dark patch. A narrow dark band on snout through eye to hindborder of operculum. Length 175 mm. [A specimen of BLEEKER's collection seen by us].

Habitat: Sumatra (Palembang, Laut Tador; Medan!); Borneo (Pontianak, Sadong). — Malay Peninsula.

In fresh water of rivers and brooks.

6. **Doryichthys martensi** (Ptrs.).

Syngnathus Martensii Peters, Monatsber. Akad. Berlin (1868) 1869, p. 459.
Syngnathus Martensii Duméril, Hist. nat. Poissons II. 1870, p. 560.
Microphis caudatus? Vaillant, Nouv. Arch. Mus. Hist. nat. (3) V. 1893, p. 62 (nec PETERS 1869).
Microphis ignoratus Vaillant, Notes Leyden Mus. XXIV. 1902, p. 40.
Doryichthys (Microphis) ignoratus Popta, Notes Leyden Mus. XXVII. 1906, p. 211.
Doryichthys Martensi Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 53.

D. 31—36; A. 3—4; P. 16—20; C. 9; Rings 15—17 + 33—37; subdorsal rings 1—2 + 5—7.

Shields transversally striated or corrugated, the keels smooth. Inferior cristae of trunk and tail continuous. Median cristae of trunk and superior cristae of tail subcontinuous, as both are

incompletely or completely interrupted subdorsally on the last trunk- or the first tail-ring; eventually the cristae mediae of the trunk are deflected to the inferior cristae of the tail, but they don't unite. Operculum vaulted, with complete longitudinal keel from which diverge more or less pronounced corrugated lines. Head 7 times or more in length. Eye about 4.5 times in head, about 2.3 times in snout. Length of snout equal to remaining part of the head. The median keel of snout reaches to nostrils and according to PETERS even to occiput. Tail longer than trunk and head. Caudal twice as long as eye. Reddish brown, laterally on the limit of the fourth to the penultimate ring of the trunk a black spot on the median crista. Length 125 mm. [Specimens of *Microphis ignoratus* Vail. in the Leiden Museum seen by us].

Habitat: Sumatra (DUNCKER); Borneo (Lake Danau Sriang, river Sebruang: an affluent of river Kapuas!, river Mandai!, upper course of Mahakkam!). — Malay Peninsula.

In fresh water of lakes and rivers.

Doubtful species.

Doryichthys fluviatilis (Blkr.).

Syngnathus fluviatilis Bleeker, Verh. Bat. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen, p. 18 (after an inedited figure of VAN HASSELT; nec PETERS, Ber. Verhandl. Akad. Berlin, 1852, p. 685).
Microphis fluviatilis Duméril, Hist. nat. Poissons II. 1870, p. 598 (after BLEEKER).
Doryichthys fluviatilis Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 55 (after BLEEKER, nec DUNCKER, ibid. XXI. 1904, p. 188).

D. 29; A. 4; Rings 18—19 + 32; subdorsal rings 3—4 + 4—5.

Much elongate. Height about 18—19 in total length. Character of cristae and operculum unknown. Head about $6^3/_4$ times in length. Eye 6—7 times in head. Snout much longer (but less than twice) than postorbital part of head. Tail, the caudal included, slightly longer than trunk and head, but less than twice longer than trunk alone. Colour greenish. Length 139 mm.

Habitat: Java (Batavia, in fresh water).

Note: This species is only known from the description of BLEEKER, made after an inedited figure of VAN HASSELT. It has never been found again and is therefore rather dubious; perhaps it is identical with *D. deokhatoides* (Blkr.).

In the Leiden Museum is a specimen (N°. 3852) collected

by KUHL and VAN HASSELT in Java, with the label *Syngnathus fluviatilis* K. & v. H., written in their time. This specimen, 186 mm. long, is evidently a *Microphis brachyurus* Blkr. and therefore quite different from the above named species.

5. Coelonotus Peters.

(PETERS, Monatsber. Akad. Berlin, 1855, p. 465. — Reise nach Mossambique, Zool. IV. Flussfische, 1868, p. 106).

Body round and very slender when young, in the adult female much compressed. The superior cristae only are conspicuous, the remaining cristae rounded, smooth and nearly inconspicuous. Head without or with very feeble ridges. Superior cristae of trunk and tail discontinuous, subdorsally they run closely and parallel to each other and unite at posterior end of dorsal. Median cristae of trunk and inferior cristae of tail continuous. Intermedial shields (scutella) present as also a

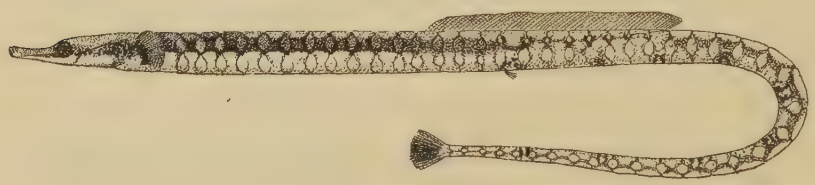

Fig. 24. *Coelonotus liaspis* (Blkr.) n. s.

praenuchal and two nuchal shields. Operculum without keel or with the indication of a keel at its base, but with radial furrows and lines. Snout short, equal to or shorter than postorbital part of head. Tail longer than head and trunk. Dorsal long, with more than 40 rays, situated above at least 12 rings belonging for their largest part to the tail; anal before middle of length. Pectorals present; caudal well developed or small. Eggs rather large, in isolated cells, formed by the skin of the abdomen and laterally protected by ventrally converging plates, which belong to the lower lateral edges of the trunk, the posterior ends of which are connected by a fold of the skin.

Distribution: Living in fresh water of brooks and rivers from East Africa, Madagascar and neighbouring islands through the indo-australian Archipelago to the Philippines, Japan and West-Pacific islands.

Key to the indo-australian species of Coelonotus.

1. Operculum with a feeble keel in its basal half; head less than thrice in length of trunk . . . . . *C. argus* p. 57.
2. Operculum without keel; head thrice or more than thrice in trunk. . . . . *C. liaspis* p. 57.

1. Coelonotus argus (Ptrs).

Syngnathus argus Peters, Bericht d. Verh. Akad. Berlin, 1852, p. 685 (nec Richardson).

Coelonotus argulus Peters, Monatsber. Akad. Berlin 1855, p. 465. — Reise nach Mossambique, Zool. IV. Flussfische, 1868, p. 106.

Coelonotus argulus Duméril, Hist. nat. Poissons, II. 1870, p. 541.

Coelonotus biocellatus Günther, Cat. Brit. Mus. VIII. 1870, p. 188.

Coelonotus argulus Günther, l. c. p. 189.

Coelonotus argulus Bleeker, Enumération Poiss. de Madagascar in: Recherch. s. l. Faune de Madagascar, Leide 1875, p. 75.

Coelonotus argulus Sauvage, Poissons in: Grandidier, Hist. nat. de Madagascar XVI. 1891, p. 528.

Coelonotus argus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 56.

D. 52—53; A. 4; P. 16—17; C. 9; Rings 16 + 38—39; subdorsal rings 3—4 + 8—9.

Body rounded, the adult female compressed. Shields transversally striated. Cristae as in genus. Operculum with a feeble keel at its basal half from which radiate feeble lines. Head about 10 times in total length (with caudal), about twice and two-thirds in length of trunk. Eye $6^1/_2$ times in head. Snout slightly shorter than postorbital part of head; it is provided with 3 feeble longitudinal keels or ridges. Tail with caudal somewhat less than twice the length of head and trunk. Brownish; trunk laterally with a black point on the intermedial shields; these shields have two black points on the subdorsal part of the tail; on the postdorsal part a black point on the limits of their rings on the superior cristae. Length 142 mm. [Not seen by us].

Habitat: South Flores (according to Duncker). — Madagascar and Comores.

In fresh water of brooks.

2. Coelonotus liaspis (Blkr.) [Fig. 24, p. 56].

Syngnathus leiaspis Bleeker, Verh. Bat. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen, p. 20.

Syngnathus budi Bleeker, Act. Soc. Sc. Indo-Neerl. I. 1856, Vischsoorten Manado en Makassar, p. 77.

Hemithylacus leiaspis Kaup, Cat. Lophobr. Fish, 1856, p. 61.

Syngnathus? *budi* Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860. 13de Bijdr. Vischfauna Celebes, p. 13.
Syngnathus leiaspis Duméril, Hist. nat. Poissons II. 1870, p. 572.
Syngnathus budi Duméril, ibid.
Hemithylacus leiaspis Duméril, l. c. p. 599.
Syngnathus budi Günther, Cat. Brit. Mus. VIII. 1870, p. 176.
Coelonotus liaspis Günther, l. c. p. 188.
Coelonotus Vaillanti Juillerat, Bull. Soc. philom. (7) IV. 1880, p. 176.
Hemithylacus leiaspis Sauvage, Poissons in: GRANDIDIER, Hist. nat. de Madagascar XVI. 1891, p. 507.
Coelonotus Vaillanti Sauvage, l. c. p. 508.
Syngnathus budi Max Weber, Nova Guinea V. 1908, Fische p. 228.
Coelonotus leiaspis Jordan & Richardson, Bull. Bur. Fish. XXVII (1907) 1908, p. 246.
Siphostoma yoshi Snyder, Proc. U. S. Nat. Mus. Wash. XXXVI. 1909, p. 597.
Syngnathus yoshi Snyder, l. c. XLII. 1912, p. 407 and plate 51, fig. 3.
Syngnathus yoshi Jordan, Tanaka & Snyder, Journ. Coll. Sci. Univ. Tokyo XXXIII. 1913, p. 95.
Coelonotus leiaspis de Beaufort, Bijdr. Dierkunde, 19e Aflev. Amsterdam 1913, p. 103.
Coelonotus liaspis Duncker, Mitt. a. d. naturh. Mus. Hamburg, XXXII. 1915, p. 57.

D. 51—60 [1]); A. 4; P. 17—19; C. 8—9; Rings 17—18 + 32—34; subdorsal rings 4—5 + 8—9.

Body more or less compressed; tail quadrilateral. Lateral shields with transverse striae, interrupted by a broad median part which is corrugated as also the intermedial shields. Cristae as in genus. Operculum without keel and with or without feeble radial furrows. Head about 9 to more than 10 times in total length (with caudal), thrice or more in length of trunk. Eye 5—6 times in head. Snout about equal to postorbital part of head, it is somewhat concave with feeble lateral ridges. Tail, without caudal, much longer than head and trunk. Dorsal lower than height of body. Caudal rounded, about as long as postorbital part of head. When the colour is preserved, dorsal surface of body and tail brown, ventral surface yellowish. A dark brown stripe running from hindmargin of eye along the sides of the trunk. The anal ring and the second, fourth, fifth, seventh, tenth, thirteenth, fifteenth, eightteenth, twenty-second and twenty-sixth tail-ring are speckled with brown on the ventral side, giving to the rings a tortoise-shell-like appearance, or the tail has brown edged ocelli, the centre of which is formed by the whitish intermedial shields. Length 159 mm.

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1) According to SNYDER D. 48.

[Specimens of *Syngnathus leiaspis* Blkr. and of *S. budi* Blkr. of BLEEKER's collection in the Leiden Museum seen by us [1])].

Nom. indig.: Budi (Menado).

Habitat: Java (Batavia!); Borneo!; Celebes (Menado, Tanawanko); Island Taliabu (Wai Meha!); Buru!; Waigeu (river Rabiai!); North New Guinea (river Klipong!). — Philippines, Japan and Madagascar.

In fresh and brackish water of rivers and brooks.

6. Belonichthys Peters.

(PETERS, Reise nach Mossambique, Zoologie IV, Flussfische, 1868, p. 108. — Monatsber. Akad. Berlin (Februar 1868) 1869, p. 147).

Body feebly heptagonal, as all the cristae are smooth and rounded. Edges on head low and smooth. Superior cristae of trunk and tail discontinuous, as also the inferior cristae of trunk and tail, median cristae of trunk and inferior cristae of tail continuous. Intermedial shields (scutella) present as also a praenuchal and two nuchal shields. Operculum without keel, with feeble, radiating furrows. Snout short, about equal to postorbital part of head. Tail equal to or longer than head and trunk. Anal before or in middle of total length. Dorsal long with more than 60 rays, situated above 15 or 16 rings, 11—12 of which belong to the trunk; pectorals present; caudal well developed. Eggs in isolated cells, formed by the skin of the abdomen, and covered by ventrally converging plates, which belong to the lower lateral edges of the trunk.

Distribution: see that of the single species known.

1. Belonichthys fluviatilis (Ptrs.) [Fig. 25, p. 60].

Syngnathus fluviatilis Peters, Ber. d. Verh. Akad. Berlin, 1852, p. 685.
Syngnathus zambezensis Peters = *Doryichthys zambezensis* Peters, Monatsber. Akad. Berlin, 1855, p. 465.
Syngnathus mento Bleeker, Act. Soc. Sc. Indo-Neerl. I. 1856, Vischsoorten Manado en Makassar, p. 75.

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1) The same Museum contains also the following specimens of *C. liaspis* (Blkr.): one bottle (3855) with the label "*Syngnathus microgmathus* s. n. *Syngnathus compressus* K. & v. H." Java, coll. by KUHL and VAN HASSELT; the other (3854) with the label "*Syngnathus microgmathus* K. & v. H." coll. by MÜLLER in Borneo. We presume that KAUP took notice of the first bottle, when he mentioned as synonyms of his *Hemithylacus leiaspis* Kp. (Cat. Lophobr. fish 1856 p. 61) "Syngnathus micropterus et compressus, Kuhl et v. Hass. MSS." "*micropterus*" is certainly a misprint for "*microgmathus*".

Fig. 25. *Belonichthys fluviatilis* (Ptrs). × 2 3/4.

Syngnathus? *mento* Bleeker, l. c. VIII. 1860, 13de Bijdr. Vischfauna Celebes, p. 13.

Belonichthys (Syngnathus) zambezensis Peters, Reise nach Mossambique, Zool. IV. Flussfische, 1868, p. 108.

Syngnathus mento Duméril, Hist. nat. Poissons II. 1870, p. 571.

Belonichthys zambezensis Duméril, ibid. p. 587 [1]).

Doryichthys mento Günther, Cat. Brit. Mus. VIII. 1870, p. 181.

Syngnathus (Belonichthys) zambezensis Peters, Sitzber. Gesellsch. naturf. Freunde Berlin, 1881, p. 108.

Syngnathus (Belonichthys) mento Peters, ibid.

Doryrhamphus mento de Beaufort, Bijdr. Dierkunde 19e Afl., Amsterdam, 1913, p. 102.

Belonichthys fluviatilis Duncker, Mitt. a. d. naturh. Mus. Hamburg, XXXII. 1915, p. 58.

D. 64—70; A. 4; P. 17—20; C. 9; Rings 19 + 23—26; subdorsal rings 11—12 + 4.

Shields transversally, intermedial shields subradially striated. Posterior rings of tail conspicuously shorter than the preceding ones. Caudal equal to or somewhat shorter than postorbital part of head. Yellowish brown. Lower surface and operculum silvery. For other characters see those of the genus. Length 188 mm. [A specimen of *Syngnathus mento* Blkr. of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Borneo (Sadong); Celebes (Menado, in brackish water); Buru (Kajeli! in fresh water). — Mossambique, Madagascar?

7. Choeroichthys Kaup.

(KAUP, Cat. Lophobr. Fish, 1856, p. 55 [2]).

Small, short, dorsally and ventrally arched. Edges of the shields finely serrated or granulated, those of the head smooth. Rings of tail more numerous than those of trunk. Superior cristae of trunk and tail continuous, inferior cristae of trunk and tail discontinuous, median cristae of trunk and inferior

1) DUNCKER unites with the present species also *Hemithylacus Rocaberti* A. Duméril, Hist. nat. Poissons II. 1870, p. 600, but the measurements of this species, especially the length of the head compared with that of the total length, differ essentially.

2) In KAUP, Arch. f. Naturgesch. XIX. 1. 1853, p. 233, appears only the name *Choeroichthys* without description.

cristae of tail continuous. Intermedial shields (scutella) present, as also a praenuchal and two nuchal shields. Operculum with complete longitudinal keel and radiating ridges or lines, especially in the lower half of the operculum. Snout rather short, slightly shorter or longer than remaining part of head. Dorsal with 21—35 rays, situated above 5—9 rings, one or two of which belong to the tail; anal behind middle of length; caudal small; pectorals present. Eggs large, isolated in open cells in the abdominal skin of the male. They are laterally protected by ventrally diverging plates; posteriorly and anteriorly these plates are provided with converging cutaneous folds, which temporarely are glued together in the median line and enclose the eggs.

Distribution: Living in the litoral region from East Africa, Mauritius, Bourbon, indo-australian Archipelago, Philippines, Japan, Australia to Pacific Islands.

Key to the species of Choeroichthys.

1. Rings 19 + 21—24; subdorsal rings 5—7 + 2. Superior and inferior lateral intermedial shields of trunk and lateral and inferior intermedial shields of tail with a longitudinal keel. . . . . *Ch. sculptus* p. 61.
2. Rings 14—15 + 18—19; subdorsal rings 4 + 1. No keels on the intermedial shields . . . . . *Ch. brachysoma* p. 62.

1. Choeroichthys sculptus (Gthr.) [Fig. 26, p. 61].

Doryichthys sculptus Günther, Cat. Brit. Mus. VIII. 1870, p. 185.
Doryichthys sculptus Boulenger, Ann. & Mag. Nat. Hist. (6) XX. 1897, p. 374.
Microphis sculptus Jordan & Seale, Bull. Bur. of Fisheries XXV. (1905) 1906, p. 214.
Doryrhamphus macgregori Jordan & Richardson, Bull. Bur. of Fisheries, Washington, 1908, p. 246.
Microphis ocellatus Snyder, Proc. U. S. Nat. Mus. Wash. XXXVI. 1909, p. 598.
Doryichthys sculptus Günther, Fische d. Südsee III. 1909—1910, p. 433.

Fig. 26. *Choeroichthys sculptus* (Gthr.) × 3.4.

Microphis ocellatus Snyder, Proc. U. S. Nat. Mus. Wash. Vol. 42, 1912, p. 495.
Choeroichthys sculptus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 59.

D. 26—35; A. 3—4; P. 18—21; C. 9—10; Rings 19 + 21—24; subdorsal rings 5—7 + 2.

Shields corrugated, their edges granulated or finely serrated. Superior and inferior lateral intermedial shields of trunk and lateral and inferior intermedial shields of tail with a longitudinal keel, giving the impression that laterally each ring on the trunk is provided with 5 and on the tail with 3 edges. Operculum with an oblique median raised keel from which radiate ventrally numerous prominent ridges and a few dorsally. Snout slightly turned upwards, equal to or somewhat longer than postorbital part of head; its keel and those on the head prominent but smooth. Tail, without caudal, shorter than trunk. Head more than 5 to 6 times in total length. Colour variable: uniform dark brown with a whitish posterior edge on caudal, or with paired light spots dorsally and laterally, or light gray with large round dark spots on the rings of trunk and tail as also on opercle and lower surface of snout. Length more than 60 mm.

Habitat: Island Samau (coral reef!). — East Africa, Abessinia (according to DUNCKER), Philippine Archipelago, Japan, New Hebrides, Fiji Islands, Rotuma, Society Islands.

On coral reefs.

2. Choeroichthys brachysoma (Blkr.).

Syngnathus brachysoma Bleeker, Nat. Tijdschr. Ned. Indië VIII. 1855, p. 327.
Choeroichthys Valencienni Kaup, Cat. Lophobr. Fish, 1856, p. 55.
Choeroichthys brachysoma Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Achtste Bijdr. Vischfauna Sumatra, p. 72.
Choeroichthys brachysoma Duméril, Hist. nat. Poissons II. 1870, p. 588.
Doryichthys valenciennii Günther, Cat. Brit. Mus. VIII. 1870, p. 187.
Doryichthys brachysoma Bleeker, Enumération d. Poiss. de Madagascar in: Recherch. s. l. faune de Madagascar, Leide 1875, p. 75.
Doryichthys Valenciennii Bleeker, Verhand. Akad. Amsterdam XVIII. (1878) 1879, p. 16.
Doryichthys serialis Günther, Report zool. coll. Voy. Alert 1884, p. 30.
Choeroichthys brachysoma Vaillant, Bull. Soc. philom. Paris. 1891, p. 10.
Choeroichthys Valenciennii Duncker, Fauna Südwest-Australiens, Pisces VI. 1909, p. 235.
Choeroichthys Valencienni Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 60.

D. 20—24; A. 4; P. 20—23; C. 9—11; Rings 14—15 + 18—19; subdorsal rings 4 + 1.

Shields with reticulated striae, their edges conspicuous, very minutely serrated. Intermedial shields (scutella) without keels. Operculum with a rough longitudinal median crista above and below it with numerous diverging lines. Snout about equal to remaining part of head, its keels smooth. Tail slightly shorter than trunk. Brown; on each side of the trunk two series of black spots. A black band running from point of snout through eye to operculum. Length nearly 60 mm. [A beautiful specimen of *Doryichthys brachysoma* Blkr. of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Batu Islands. — Bourbon, Mauritius, Cap York and Port Molle, Queensland.

8. Doryrhamphus Kaup.

(KAUP, Cat. Lophobr. Fish, 1856, p. 585) [1]).

Short, rather stout. Edges of the shields prominent, posteriorly ending in a spine but otherwise smooth, as those of the head; only the median dorsal keel on the snout is rather high and roughly serrated. Rings of trunk more numerous than those of tail. Superior and inferior cristae of trunk and tail discontinuous. Median cristae of trunk and inferior cristae of tail continuous. Intermedial shields (scutella) large. Operculum with complete longi-

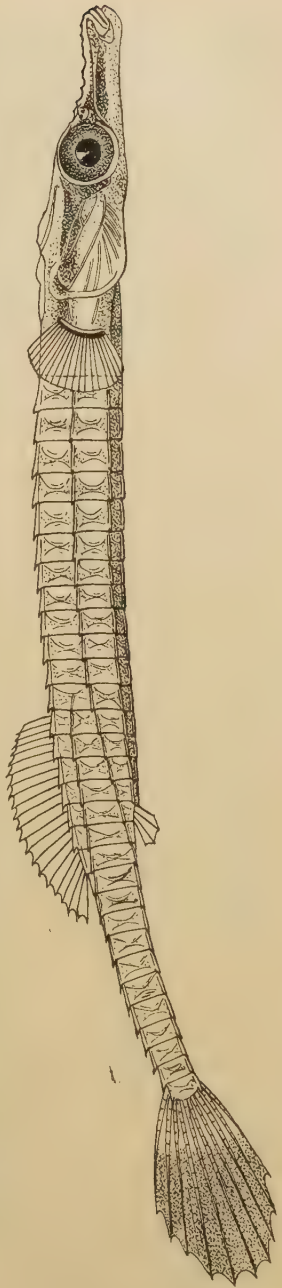

Fig. 27. *Doryrhamphus melanopleura* (Blkr.). × 2.8.

1) In KAUP, Arch. f. Naturgesch. XIX. 1, 1853, p. 233 appears only the name *Doryrhamphus* without description.

tudinal keel, from which radiate ventrally some prominent ridges. Snout short, slightly shorter or longer than postorbital part of head. Dorsal with 22—27 rays, situated above 4—6 rings of the trunk and 2—4 of the tail; anal behind middle of length; pectorals large, caudal especially so. Eggs large, isolated in cells of the abdominal skin of the male. They are enclosed by extensive lateral cutaneous folds, which are temporarely united in the median line.

Distribution: Marine shore fishes in the indo-pacific region from the Red Sea, Mauritius, Madagascar, indo-australian Archipelago, Japan to Pacific Islands.

1. Doryrhamphus melanopleura (Blkr.) [Fig. 27, p. 63].

Doryrhamphus excisus Kaup [1]), Cat. Lophobr. Fish 1856, p. 51 (pro parte).
Syngnathus melanopleura Bleeker, Nat. Tijdschr. Ned. Ind. XV. 1858, p. 464.
Doryramphus melanopleura Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Achtste Bijdr. vischfauna Sumatra, p. 72.
Doryichthys excisus Peters, Monatsber. Akad. Berlin 1876, p. 447 (nec *Doryrhamphus excisus* Kaup sensu Duncker).
Doryichthys pleurotaenia Günther, Rep. Voy. Challenger, Shore fishes, 1880, p. 62.
Doryrhamphus pleurotaenia Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 121.
Microphis pleurotaenia Jordan & Seale, Bull. Bureau Fisheries XXV (1905) 1906, p. 214.
Doryrhamphus pleurotaenia Steindachner, Sitzber. Akad. Wien Bd. CXV. 1906, p. 1419.
Doryichthys pleurotaenia Günther, Fische d. Südsee, 1910, p. 434.
Microphis extensus Snyder, Proc. U. S. Nat. Mus. Wash. XL. 1911, p. 525. — l. c. vol. XLII. 1912, p. 495.
Doryrhamphus excisus Max Weber, Siboga-Expeditie, Fische, 1913, p. 117.
Doryrhamphus melanopleura Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII, 1915, p. 61.

D. 21—25; A. 4; P. 19—22; C. 10; Rings 16—18 + 13—15; subdorsal rings 4—6 + 2—4.

Shields transversally striated; their edges, especially those of the tail, posteriorly ending in a spine. Operculum divided

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1) We agree with the opinion of Duncker, that the name *D. excisus* Kaup ought to be reserved for the species known from the Red Sea. Kaup mentions in his first paper (Arch. f. Naturgesch. XXI. 1, 1853, p. 233) only the Red Sea as locality. The specimens, which he quotes, belong to the Museum of Berlin and Paris. Those of the Berlin Museum were collected by Hemprich and Ehrenberg and belong to *D. excisus* Kaup emend. Duncker. This is also the case with the specimens from the Paris Museum, which were afterwards described by Duméril.

by an oblique longitudinal keel in a superior smaller and an inferior larger part, the last shows up to 8 prominent lines, radiating from the longitudinal keel. Snout rather stout, slightly longer than postorbital part of head, with a median high, roughly serrated crista and 2 lateral lower and less denticulated cristae. Tail much shorter than trunk. Dorsal rather high, but less than height of body. Head $4^1/_2$ to more than $5^1/_2$ times in length. Eye $4—5^1/_2$ times in head. Caudal conspicuously longer than half length of head. Deep- or grayish brown; a dark band, narrow on snout and head, is continued as a broader band on the sides of trunk and tail. Posterior half of caudal may be blackish. Length 63 mm. [A specimen of *Syngnathus melanopleura* Blkr. of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Cocos Island; Timor!; Island Samau!; New Guinea (North coast). — Mauritius, Japan, Riu Kiu Islands, Hawaiian Islands, Rotuma, Samoa.

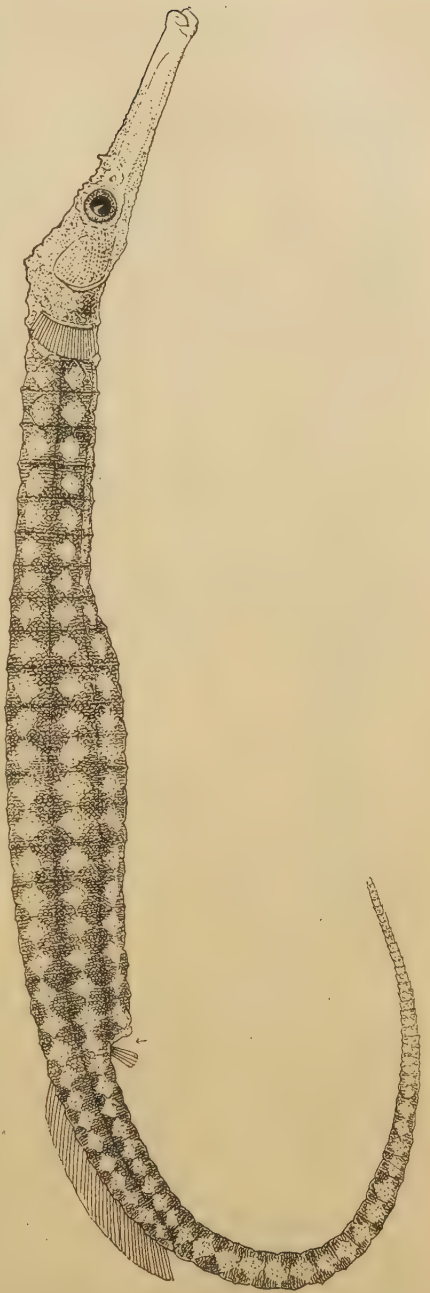

Fig. 28. *Solegnathus lettiensis* Blkr. $\times 4/5$ type of BLEEKER.

9. **Solegnathus** Swainson.

(SWAINSON, Nat. Hist. Fish. II. 1839, pp. 195, 333).

Solenognathus Kaup et auctores.

Body compressed, higher

than broad, nearly hexagonal. Tail prehensile, equal to or much shorter than trunk. Head in continuation of the longitudinal axis of the body or forming with it an obtuse angle only. Shields hard, radially rugose or with radiating lines of well-developed spines and with a stronger one in the centre. The tail-rings with or without cutaneous excrescences on their inferior surface. The edges of the rings rough or spiny. Intermedial shields (scutella) present as also two nuchal shields, praenuchal shield present or absent. Superior cristae of trunk and tail discontinuous. Inferior cristae of trunk and tail continuous. Median cristae of trunk and superior cristae of tail continuous, by exception not so. Operculum with radiating lines or edges which are smooth, granulated or rough. Dorsal situated on the anterior 10—12 caudal rings, its base not elevated. Anal and pectorals present. Caudal wanting. Eggs large, isolated in open cells belonging to the ventral surface of the anterior part of the tail.

Distribution: Marine fishes living in the indo-australian Archipelago, Australia, New Zealand and China; probably in deeper water.

Key to the indo-australian species of Solegnathus.

1. Snout about twice longer than postorbital part of head. Tail and trunk of equal length. Doral fin with 35—36 rays. Subdorsal rings 0 + 10 . . . . . *S. lettiensis* p. 66.
2. Snout about thrice longer than postorbital part of head. Tail longer than trunk. Dorsal fin with about 46 rays. Subdorsal rings 0 + 12 . . . . . *S. güntheri* p. 67.

1. Solegnathus lettiensis Blkr. [Fig. 28, p. 65].

Solenognathus lettiensis Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 12de Bijdr. vischfauna Amboina, p. 3.
Solenognathus lettiensis Duméril, Hist. nat. Poissons II. 1870, p. 530.
Solenostomus [1]) *lettiensis* Günther, Cat. Brit. Mus. VIII. 1870, p. 516.
Solenognathus lettiensis Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 66.

D. 35—36; A. 4; P. 26—27; Rings 22—23 + 50—51; subdorsal rings 0 + 10.

Much elongate, anteriorly pentagonal or hexagonal, poste-

1) This is certainly a misprint for *Solenognathus*.

riorly tetragonal. Head forming an obtuse angle, about $6^1/_4$ in total length. Eye somewhat more than 7 times in head. Occiput posteriorly and orbits provided with some rough tubercles. Snout somewhat more than twice longer than postorbital part of head, with a conical tubercle in front of the eyes. Operculum radially roughly rugose. Shields with radial rugosities, their edges slightly elevated, rough and partly provided with a conical tubercle. Length of tail equal to that of trunk. Dorsal somewhat longer than snout. Pectorals about as long as eye. Yellowish brown; shields dorsally with a single brown spot; tail with 7—8 broad diffuse bands. Length of the single specimen known 312 mm. [Type of BLEEKER, in the Leiden Museum seen by us].

Habitat: Island Letti, one of the "south-western" islands of the Banda Sea! [1]).

2. Solegnathus güntheri Duncker [2]).
[Fig. 29, p. 67].

Solenognathus Hardwickei Günther, Cat. Brit. Mus. VIII. 1870, p. 195 (p. p.).

Solenognathus Güntheri Duncker, Mitt. Naturh. Mus. Hamburg XXXII. 1915, p. 65.

D. (42) 46; A. 4; P. 22—26; Rings (24 + 53) 23 + 55—56; subdorsal rings (0 + 11) 0 + 12.

Much elongate; head nearly in the continuation of the axis of the trunk; 1.9 to 2.17 (2.5) in trunk and 5.6 (5.8) in total length. Snout about $^2/_3$ of length of head and nearly thrice (less than thrice) longer than its postorbital part. Orbital ring with spines, especially below and above, those above forming a series of strong, prominent spines, anteriorly conti-

Fig. 29. *Solegnathus güntheri*. × $^1/_2$. Left figure outline of dorsal scutes (magnified).

1) By DUMÉRIL and DUNCKER Amboina is erroneously stated as habitat of this fish.

2) Description made after the two fresh alcohol-specimens; the figures in brackets are taken from DUNCKER's description of the dried specimen in the British Museum.

nued as a spiny rim. Both opposite rims converge and unite into a spiny patch on the posterior half of the snout. Interorbital space concave [1]), smaller than eye. Lower half of operculum with distally radiating short spiny lines. Superior limit of operculum with a sharp oblique crest from orbita to branchial opening. Occiput elevated into a broad blunt tubercle. Eye 9 to 9.7 times in head, somewhat more than twice in postorbital part. Trunk pentagonal with a flat dorsal surface, much shorter than tail; ventrally strongly convex in the last $^2/_3$ of its length, less so dorsally; its greatest height about 19 times in the total length and somewhat more or less than length of head without snout. Superior cristae of trunk ending below end of dorsal; median cristae of trunk strongly developed and continued in superior cristae of tail. Scutella more or less oval with irregular transverse or radial blunt tubercles, which are transversally arranged on the scuta. In the younger specimen the scutella have about 5 irregular cristae diverging from the centre, and the scuta are more spinous; in those on the tail the edges are finely spinous, with the central spine the highest. Dorsal fin longer than snout; pectorals equal to eye. About 7 to 8 rounded blackish patches at least as broad as a ring; 4 to 6 on trunk, the first on about the 4th or 5th ring; one on root of tail, one or two smaller ones behind it. Length of the 2 described specimens (in the Museum of Amsterdam and Buitenzorg, Java) 259 and 386 mm.; length of the dried specimen in the British Museum about 475 mm.

Habitat: Strait Madura! (lieutenant Vink leg.); Houtmans Abrolhos! (British Museum).

10. Corythoichthys Kaup (p. p.).

(*Corythöichthys* Kaup, Cat. Lophobr. Fish, 1856, p. 25).

Corythroichthys Jordan & Snyder [2]), Proc. U. S. Nat. Mus. Wash. XXIV. 1901, p. 7 (nec. Kaup).

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1) We find it concave also in the type-specimen in the British Museum.

2) It seems that JORDAN & SNYDER have introduced in 1901 the name *Corythroichthys* (from κορύρος crown, a word about which GÜNTHER already remarked, that it does not exist in the greek language, and ἰχθύς fish) in which they were followed by different writers who added "Kaup" as author, or they used the name — as DUNCKER did — as a synonym of *Corythöichthys* Kaup. Besides that this proceeding is against every rule of priority, there was no reason why

Corythroichthys Duncker, in Fauna Südwest Australiens, Pisces, 1909, p. 237.
Corythoichthys Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 72.

Body short, rather stout. Shields rough, with the edges more or less prominent and smooth, slightly crenulated, by exception serrated. Snout slender, straight, equal to postorbital or remaining part of head; its ventral profile forming a straight line with ventral profile of head; its dorsal profile abruptely rising to orbits, which are prominent. The dorsal profile of the head rising abruptely in its orbital part, forming an angle with the snout; the front and eyes prominent. Occiput and nuchal shields with a distinct median, more or less scalloped crest. Supraorbital ridges continued on occiput. Operculum crossed by a complete longitudinal keel. Superior cristae of tail and trunk discontinuous; inferior cristae of trunk and tail continuous; median cristae of trunk and superior cristae of tail subcontinuous. Intermedial shields (scutella) present as also a praenuchal and one nuchal shield.

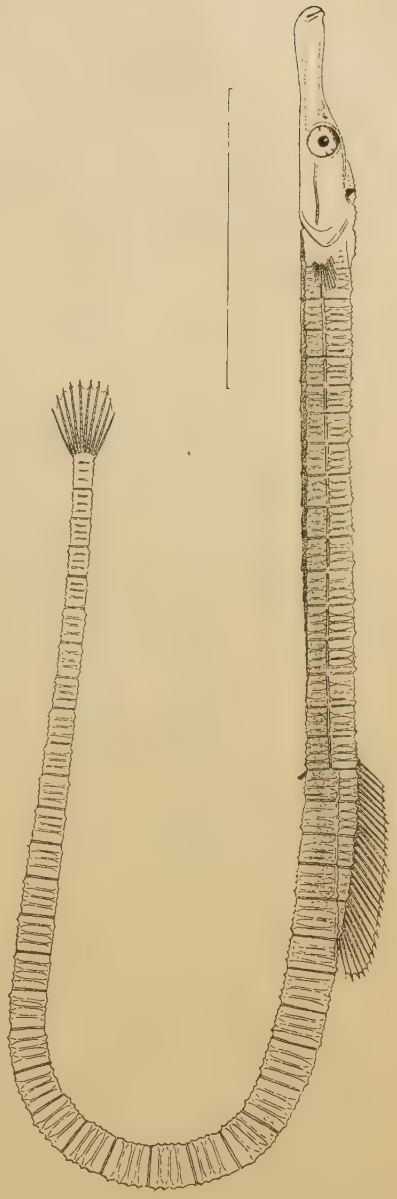

Fig. 30.
Corythoichthys crenulatus M. Web.
× 4.

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the name *Corythöichthys* of Kaup ought to be changed. DUMÉRIL has already shown that it was derived from κόρυς, υος helmet and ἰχθύς fish and therefore more correct than the innovation of JORDAN & SNYDER.

Tail more or less than twice as long as trunk. Dorsal situated totally or nearly totally on the anterior caudal rings, with 20—34 rays. Anal, pectorals and caudal present. Eggs small, numerous, incompletely isolated in cutaneous cells on the lower surface of the tail, laterally protected by low diverging cutaneous folds.

Distribution: Marine fishes living on coral reefs and near the shore in the indo-pacific region and on the east coast of central and tropical South America.

Key to the indo-australian species of Corythoichthys.

A. Length of snout about equal to half length of head.

1. All the edges on head, body and operculum smooth; or those of the body only slightly corrugated, even in young specimens . . . . . *C. fasciatus* p. 70.
2. All the edges on head, body and operculum sharply serrated; the fish therefore strongly adhering . . . . . *C. crenulatus* p. 72.

B. Length of snout much less than half length of head.

1. All the edges on head, body and operculum corrugated or slightly serrated, the fish not adhering . . . *C. corrugatus* p. 73.

1. Corythoichthys fasciatus (Gray). [Fig. 31, p. 71].

Syngnathus fasciatus Gray, Illustr. Ind. Zool. I. 1830—1832, pl. 89, fig. 2 and 2*a* (nec Risso, 1810).

Syngnathus flavofasciatus Rüppel, Neue Wirbelthiere, Fische, 1840, p. 144.

Syngnathus haematopterus Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 258. — Verh. Batav. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen, p. 20.

Syngnathus fasciatus Peters, Monatsber. Akad. Berlin 1855, p. 465. — Arch. f. Naturgesch. XXI. 1. 1855, p. 277.

Corythöichthys fasciatus Kaup, Cat. Lophobr. Fish, 1856, p. 25.

Syngnathus fasciatus Duméril, Hist. nat. Poissons II. 1870, p. 543 (p. p.).

Syngnathus conspicillatus Günther, Cat. Brit. Mus. VIII. 1870, p. 174 (p. p. nec Jenyns).

Syngnathus flavofasciatus Klunzinger, Abhandl. zool.-bot. Gesellsch. Wien XXI. 1871, p. 649.

Syngnathus conspicillatus Bleeker, Arch. néerl. sc. nat. XIII. 1878, p. 49 (nec Jenyns).

Ichthyocampus papuensis Sauvage, Bull. Soc. philom. (7) IV. 1880, p. 228.

Syngnathus conspicillatus Lunel, Mém. Soc. phys. sc. nat. Genève XXVII. 1881, p. 291 (nec Jenyns).

Syngnathus intestinalis Ramsay, Proc. Linn. Soc. N. S. Wales, 1881, p. 494.

Syngnathus conspicillatus Day, Fishes of India, 1878—1888, p. 808 (nec Jenyns).

Corythroichthys isigakius Jordan & Snyder, Proc. U. S. Nat. Mus. XXIV. 1901, p. 7.

? *Corythroichthys waitei* Jordan & Seale, Bull. Bur. of Fisheries Wash. XXV. (1905) 1906, p. 212.
Corythroichthys elerae Evermann & Seale, Bull. Bur. of Fisheries Wash. XXVI. (1906) 1907, p. 57.
Corythroichthys conspicillatus Duncker, Spolia Zeylanica VII. 1910, p. 29 (nec JENYNS).
Syngnathus haematopterus Günther, Fische der Südsee 1910, p. 431 (p. p.).
Corythroichthys waitei McCulloch, Proc. Linn. Soc. N. S. Wales XXXV. 1910, p. 432.
Corythroichthys intestinalis McCulloch, Zool. Results "Endeavour" I. 1911, p. 26.
Corythroichthys ishigakius Snyder, Proc. U. S. Nat. Mus. Wash. vol. 42, 1912, p. 494.
Syngnathus flavofasciatus Max Weber, Siboga-Expeditie, Fische. 1913, p. 108.
Corythoichthys fasciatus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 72.
Corythoichthys fasciatus Bamber, Journ. Linn. Soc. London. Zool. XXXI. 1915, p. 479.

D. 25—32; A. 3—4; P. 14—18; C. 9—11; Rings 15—18 + 33—37; subdorsal rings 0—1 + 5—6.

Body robust. Shields transversally striated and corrugated. Median cristae of trunk and superior cristae of tail generally incompletely interrupted between the last ring of the trunk and the first of the tail or they are completely interrupted on one of those rings. Head about 8 to more than 9. Snout half as long as head, slender, cylindrical; its ventral surface forming a straight line with that of head. A crest on each side of head above eyes. Interorbital space deeply concave; a three-lobed prominent median crest on occiput and nape. Operculum with a complete longitudinal keel. Tail equal to or somewhat more or less than twice the length of the trunk. Colour light gray with numerous broad dark cross-bands composed of fine anastamosing longitudinal lines or there are dark blotches along the sides. Operculum with numerous darkish parallel longitudinal lines or it shows ventrally a dark longitudinal band. Throat between opercles with a black median streak or with a black marmoration and behind it two or three black cross-bars on the anterior 2 to 4 rings. Length 173 mm. [A specimen of *Syngnathus haematopterus* Blkr. of BLEEKER's collection in the Leiden Museeum seen by us].

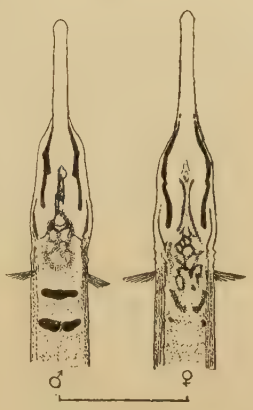

Fig. 31. *Corythoichthys fasciatus* Gray. Lower surface of head and anterior part of trunk in male and female; nearly twice n. s.

Habitat: Pulu Weh!; Island Simalur!; Batu Islands; Celebes; Saleyer!; Binongka!; Flores!; Solor!; Lomblem!; Timor; Buru; Banda; Obi major!; Ambon!; Nusa Laut; Batjan; Ternate!; Ceram; Waigeu!; New Guinea!; Kei Islands!; Sulu Archipelago!. — Red Sea; Zanzibar; Mossambique; Madagascar, Bourbon; Mauritius; Seychelles; British India; Ceylon; Philippines; China; Japan; Riu Kiu Islands; Australia; (Samoa?).

Note: This species is very near *C. conspicillatus* Jenyns (Zool. Voy. Beagle IV. Fish. 1842, p. 147) = *C. sealei* Jordan & Seale (Bull. Bur. of Fisheries XXV. (1905) 1906, p. 213). The only real difference seems to be that its snout is still more slender and conspicuously less than half the length of the head. It seems to be restricted to the Pacific Islands whereas *C. fasciatus* is a more western form. Perhaps DUNCKER is right when he supposes that *C. conspicillatus* Jenyns is only a local variety of *C. fasciatus*.

2. **Corythoichthys crenulatus** (M. Web.) [Fig. 30, p. 69].

Syngnathus crenulatus Max Weber, Siboga-Expeditie, Fische. 1913, p. 109.

D. 27—30; P. 14; Rings 15—17 + 35—40; subdorsal rings 1 + 5—6.

Extremely slender; trunk nearly four-sided, its height slightly more than its breadth; all the edges finely serrated, ending on each ring with a prominent tooth, the fish therefore strongly adhering. Head 7—8 times in length, more than twice in length of trunk. Snout nearly equal to half length of head, somewhat compressed; its dorsal profile gently rising to the orbits; its median crest ends in the narrow orbital space, which is limited on both sides by a sharp supraorbital crest, which is continued in a curve to the occiput. The occiput with a sharp crest, which is continued on the nape. All crests and edges on the head are serrated. Operculum with a rather high, sharply serrated, complete longitudinal keel. Superior cristae of trunk are continued nearly to the end of the dorsal or not so far. Superior cristae of tail reach nearly to the commencement of the dorsal; the median cristae of the trunk reach as far. Caudal equal to postorbital part of head. Tail somewhat more than twice the length of trunk. Colour diffuse grayish with somewhat light cross-bars on the tail. Snout

darker with a blackish longitudinal streak or the colour is light yellow with black points on the snout, a blackish network on the head and faint cross-bars on about each second ring formed by blackish rings between each pair of edges. Length 61 mm.

Habitat: Java (Samarang!); Island Binongka!; Timor (Kupang!).

All the specimens were caught on the surface of the sea.

Note. The above description is based on young specimens of which the fullgrown form is not yet known. They cannot belong to *Corythoichthys fasciatus* (Gray) as DUNCKER (Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 73) thought probable. We had the opportunity to compare with the above described specimens about thirty juvenile specimens of *C. fasciatus* of the same or somewhat smaller or larger size. They show the same form of snout, the dorsal profile of which does not yet rises abruptely, but gently, to the orbital region. This is therefore indeed a juvenile character, but the young ones of *C. fasciatus* do not show the slightest trace of the sharp serrature of all the edges of head and body and operculum, which is so characteristic of *C. crenulatus*. Besides *C. crenulatus* seems to be a true pelagic species. At least, all known specimens were caught in surface nets partly with the help of electric light.

3. **Corythoichthys corrugatus** (M. Web.) [1]). [Fig. 32, p. 74].

Syngnathus corrugatus Max Weber, Siboga-Expeditie, Fische. 1913, p. 112.

D. 32; P. ca. 15; Rings 15 + 42; subdorsal rings 1 + 7.

Body rather stout, the ventral crista prominent, heptagonal. Tail tetragonal, more than $2^1/_2$ times as long as trunk. All the shields corrugated as also the head; all the edges on head and shields prominent and finely serrated or corrugated. Intermedial shields (scutella) wanting. Head 10 times in length; nearly three times in length of trunk. Snout short, one third longer than diameter of eye and slightly shorter than postorbital part of head; its dorsal surface deeply concave, abruptly rising to orbital part of head, which is prominent. Median

1) We are not sure about the *generic* position of the single specimen we possess.

line of snout with a series of isolated spines, which are continued as a low crest on the concave, very narrow interorbital space; a low somewhat scalloped crest on occiput and nape. In front of each nostril a prominence with about four spines. Orbital borders denticulated; from their dorsal middle a curved, denticulated ridge runs to end of occiput. Similar ridges below orbitae and on lower surface of snout, which forms a straight line with the lower surface of head. Operculum with a complete denticulated longitudinal keel and radiating lines. Superior cristae of trunk continued to end of dorsal but not continuous with the superior cristae of tail; these proceed anteriorly to the frontborder of the last ring of trunk. Inferior cristae of trunk and tail continuous. Median cristae of trunk ending at frontborder of first tail-ring, their end situated below anterior end of superior cristae of tail. Base of dorsal not elevated. Pectorals and anal very small as also the caudal, which is truncated. Alternating dark and light brown transverse bands corresponding with the rings; on the tail the light bands are gaining in size posteriorly. Head darkish, with an indication of irregular light bands; snout with dark points. Length of single specimen known 65 mm.

Habitat: Karakelang Islands!

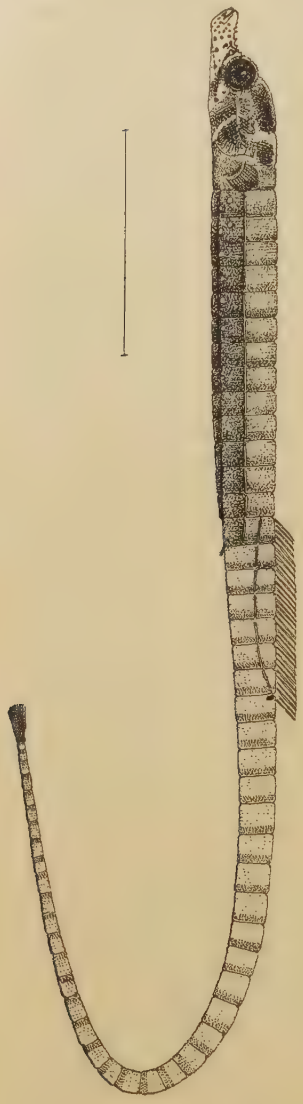

Fig. 32. *Corythoichthys corrugatus* M. Web. × 3.

11. Micrognathus Duncker.

(Duncker, Mitt. a. d. naturh. Mus. Hamburg XXIX. 1912, p. 235).

Body elongate, more or less stout; anteriorly heptagonal, posteriorly tetragonal. Rings transversally striated, their keels moderately prominent, smooth or

only posteriorly finely dentated or somewhat spinous. Ridges on head generally feeble; cutaneous appendages on head and body generally present. Snout stout, more or less curved upward, very short, about equal to postorbital part of head, rising more or less gently to orbital region. Keel on operculum only anteriorly visible, reaching not farther than to its middle. Superior cristae of trunk and tail discontinuous as also the inferior cristae of trunk and tail. Median cristae of trunk and inferior cristae of tail continuous. Intermedial shields (scutella) large; a praenuchal and a nuchal shield present. Tail equal to or somewhat more or less than twice the length of the trunk. Dorsal short with 17—23 rays, its base not elevated, situated on one or two of the last body-rings or on none and on 3—5 tail-rings. Pectorals, anal and caudal present. Eggs rather large, isolated in cutaneous cells on the anterior 14 or 15 rings of the tail; they are laterally protected by thin cutaneous folds which begin behind anal and converge posteriorly; they coalesce temporarely in the median line. These skin-folds may contain feebly developed bony plates.

Distribution: Marine fishes living on coral reefs and in litoral water in the indo-pacific region and in the Caribbean Sea.

Key to the indo-australian species of Micrognathus.

1. Snout without a median crest; equal to or somewhat shorter than postorbital part of head . . . . . *M. brevirostris* p. 75.
2. Snout with a median crest of 4—6 strong teeth; much shorter than postorbital part of head . . . . . *M. mataafae* p. 77.

1. **Micrognathus brevirostris** (Rüpp.).

Syngnathus brevirostris Rüppell, Neue Wirbelthiere. Fische des Rothen Meeres, 1840, p. 144.
Syngnathus sundaicus Bleeker, Verh. Batav. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen p. 21.
Corythöichthys brevirostris Kaup, Cat. Lophobr. Fish, 1856, p. 28.

Fig. 33. *Micrognathus mataafae* (Jordan & Seale) × 2.5.

Syngnathus Andersonii Bleeker, Nat. Tijdschr. Ned. Ind. XV. 1858, p. 465.
Syngnathus tetrophthalmus Bleeker, ibid. p. 467.
Syngnathus sundaicus Duméril, Hist. nat. Poissons II. 1870, p. 556.
Syngnathus tetrophthalmus Duméril, l. c. p. 563.
Syngnathus Andersonii Duméril, l. c. p. 564.
Syngnathus brevirostris Duméril, l. c. p. 565.
Syngnathus brevirostris Günther, Cat. Brit. Mus. VIII. 1870, p. 167.
Syngnathus tetrophthalmus Günther, l. c. p. 169.
Syngnathus brevirostris Klunzinger, Abhandl. zool.-bot. Gesellsch. Wien XXI. 1871, p. 652.
Corythroichthys tanakae Jordan & Starks, Proc. U. S. Nat. Mus. Wash. XXX. 1906, p. 696.
Corythoichthys spinicaudatus Ogilby, Ann. Queensl. Mus. N°. 9, 1908, p. 16.
Corythroichthys tanakae Snyder, Proc. U. S. Nat. Mus. Wash. vol. 42, 1912, p. 407.
Syngnathus brevirostris de Beaufort, Bijdr. tot de Dierkunde, 19de afl. Amsterdam. 1913, p. 102.
Syngnathus brevirostris Max Weber, Siboga-Expeditie, Fische. 1913, p. 106.
Micrognathus brevirostris Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 75.

D. 17—22; A. 2—4; P. 9—14; C. 10; Rings 15—17 + 28—32; subdorsal rings 0—2 + 3—5.

Body somewhat compressed, its edges prominent, sometimes slightly dentated. Shields transversally striated. Head nearly 9 to more than 10. Eye $5—5^1/_2$ in head. Snout very short, stout, somewhat curved upward, equal to or somewhat shorter than postorbital part of head, as long as eye or half its length longer and $2^1/_2—3$ times in length of head, without median crest or spines or with a feeble crest only. Operculum with short feeble basal keel, which may reach to middle of its length and with radiating lines. Tail more than 1.6 times to about twice as long as trunk. Cutaneous appendages more or less developed on head, nape and edges of body. Colour much varying, generally dark brown with light cross-bars on back of each ring or they appear at certain distance on about 10 rings only. Colour of females generally lighter. The operculum may have a brown ocellus with a pearl-coloured and a brown peripheral ring. Length 75 mm. [A specimen of *Syngnathus tetrophthalmus* Bikr. of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Singapore!; Java; Cocos Islands; Sangir Islands; Sula Besi Island!; Gisser Island!; Waigeu!; New Guinea!; Timor. — Thursday Island!; Red Sea; Zanzibar; Mossambique; Japan; Australia (Sydney, Cape York).

2. Micrognathus mataafae (Jordan & Seale).

[Fig. 33, p. 75].

Corythroichthys mataafae Jordan & Seale, Bull. Bur. Fish. XXV. (1905) 1906, p. 213.
Syngnathus mataafae Günther, Fische d. Südsee. 1910, p. 431.
Syngnathus mataafae Max Weber, Siboga-Expeditie, Fische. 1913, p. 112.
Micrognathus Mataafae Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 76.

D. 21—23; A. 2—3; P. 12—13; C. 10; Rings 15 + 34—35; subdorsal rings 1 + 4.

Trunk heptagonal, tail tetragonal; more slender than preceding species. Edges of rings smooth. Intermedial shields large. Head more than 10 to more than $11^1/_2$ times in length. Eye more than $3^1/_2$ times in head. Snout very short, thick, with a median crest of 4—6 rather strong teeth; it is longer than eye and than half length of postorbital part of head, about thrice in length of head. Operculum with a feeble basal keel but with numerous radiating lines. A fringed cutaneous appendage on top of each orbit and a single one on middle of nape, besides a pair on snout behind eye. Tail twice or more longer than the length of the trunk. Caudal short, about equal to eye. Anal minute; pectorals shorter than opercle. Colour whitish, a silvery brown rimmed spot on the intermedial shields. Head with dusky lines and spots or light brown with 10—11 whitish cross bars on back, 3 in front of dorsal, 2 below dorsal, the others on tail. Length 115 mm.

Habitat: Timor!; Island Salomakiëe!. — Samoa.

On coral reefs.

12. Syngnathus Linné (Kaup).

(Linné, Syst. nat. edit. X. 1758, p. 336).
Kaup, Cat. Lophobr. Fish, 1856, p. 32.

Body slender, elongate, not compressed, hexagonal, or tetragonal, tapering into a long tetragonal tail. Shields more or less transversally striated, their edges smooth or serrated. Intermedial shields (scutella) generally present as also a nuchal and praenuchal shield. Superior cristae of trunk and tail discontinuous; inferior cristae of trunk and tail continuous; median cristae of trunk and inferior cristae of tail discontinuous, but the former and the superior cristae of tail continuous or subcontinuous. Head generally slender and tapering gently into

Fig. 34. *Syngnathus spicifer* Rüpp.
Female to the left × 3/2.
Male to the right × 4/3.

a longer or shorter tube-like snout with or without a median keel. Operculum with a straight longitudinal keel, which is complete or restricted to the basal part. Oblique lines or edges radiate from the keel or are wanting. Dorsal with 21—45 rays, which are inserted exclusively on the anterior tail-rings up to the ninth or also on one to three of the last rings of the trunk; base of dorsal not elevated; pectorals, anal and caudal present. Eggs isolated in cutaneous cells on ventral surface of anterior part of tail, they are totally protected by cutaneous folds, which may contain more or less developed bony plates. These folds begin next to anus, reach far behind subdorsal rings of tail and coalesce in the median line, splitting lengthwise to release the young fishes. Both sexes without much difference in exterior.

Distribution: Living in temperate and tropical seas; some also in brackish or fresh water.

Key to the indo-australian species of Syngnathus.

I. Operculum with a rectilinear complete keel. Median cristae of trunk subcontinuous with superior or inferior cristae of tail (*Parasyngnathus* Duncker).

A. Dorsal situated on tail only.

1. Snout equal to or slightly longer or shorter than postorbital part of head. Brown, trunk ventrally paler or reticulated with brown. Tail spotted; head with 3 blackish bands radiating from eye. . *S. djarong* p. 79.
2. Snout longer but less than twice than postorbital part of head. Trunk ventrally with 13—15 white crossbars. . . . . *S. spicifer* p. 80.

3. Snout longer than remaining part of head. Trunk with 7 longitudinal series of pearly ocelli . . . *S. argyrostictus* p. 82.

B. Anterior part of dorsal inserted on last trunkrings.

1. Snout equal to postorbital part of head. Tail twice length of trunk. Dorsal 21—25, rings 17 + 41 . . . . . *S. fasciolatus* p. 83.

2. Snout longer than postorbital part of head. Dorsal 30; rings 13 + 32—36. . . . . *S. cyanospilus* p. 83.

3. Snout equal to remaining part of head. Dorsal 28; rings 15 + 42. . . . . *S. uncinatus* p. 84.

II. Operculum with a rather low keel, restricted to its basal third. Median cristae of trunk and superior cristae of tail subcontinuous (*Siphostoma* Duncker).

1. Dorsal 23; trunk nearly twice in tail. . . . . *S. punctatus* p. 86.

2. Dorsal 29—31; trunk 1.7 in tail . . . . . *S. pelagicus* p. 87.

3. Dorsal 35—45; trunk twice to nearly $2\frac{1}{2}$ times in tail. *S. acus* p. 88.

1. Syngnathus djarong Blkr.

Syngnathus djarong Bleeker, Verhand. Batav. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen, p. 22. — Nat. Tijdschr. Ned. Ind. VII. 1854, p. 325. — l. c. IX. 1855, p. 429.

Syngnathus Helfrichii Bleeker, Nat. Tijdschr. Ned. Indië IX. 1855, p. 428.

Syngnathus spicifer var. *rivalis* Peters, Monatsber. Akad. Berlin 1869, p. 276 (fide Duncker).

Syngnathus djarong Duméril, Hist. nat. Poissons II. 1870, p. 545.

Syngnathus Helfrichii Duméril, l. c. p. 547.

Syngnathus spicifer Günther, Cat. Brit. Mus. VIII. 1870, p. 172 (p. p.).

Syngnathus parviceps Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales (2) I. 1886, p. 475.

Syngnathus spicifer var. *djarong* Duncker, Spolia Zeylanica Vol. VII. prt. XXV. 1910. p. 31 and 32.

Syngnathus djarong Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 80.

D. 23—29; A. 2—3; P. 13—16; C. 10; Rings 14—16 + 39—43; subdorsal rings: 2nd—6th or 3rd—8th caudal ring.

Very slender; trunk heptagonal; the ventral crista strongly prominent; tail tetragonal. Shields transversely striated, their edges prominent, smooth. Intermedial shields oval. End of median cristae of trunk on the last body-ring strongly deflected to inferior cristae of tail but not united with them. Superior cristae of tail in most cases reaching the first tail-ring. Head about 9—12 times in length, rather low; its profile from point of snout to front concave. Occiput smooth. Snout equal to or slightly longer or shorter than postorbital part of head. Operculum inflated, with a complete longitudinal keel from whence

radiate striae. Eye about 4—5 times in head. Tail somewhat more or less than twice longer than trunk. Brown, trunk ventrally paler, or it is reticulated with brown and the tail ventrally more or less spotted. Head with 3 blackish bands radiating from the eye, one along the snout, a second to the temples, a third inferiorly along the operculum; the lower surface of snout and head may also be black-spotted. Length 140 mm. [Specimens of *S. djarong* Blkr. and *S. Helfrichi* Blkr. of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Singapore; Sumatra (Trussan, Tandjong); Simalur!; Nias!; Java (Dirk de Vries Bay!); Borneo (Banjermassin); Waigeu (riverRabiai!) New Guinea!. — Ceylon; Philippines; New South Wales (Clarence river).

In brackish water and fresh water of brooks and rivers.

2. Syngnathus spicifer Rüpp. [Fig. 34, p. 78].

Syngnathus spicifer Rüppell, Neue Wirbelthiere, Fische des Rothen Meeres, 1840, p. 143.
Syngnathus gastrotaenia Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 713. — Verhand. Batav. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen, p. 22. — Nat. Tijdschr. Ned. Ind. IX. 1855, p. 430.
Syngnathus tapeinosoma Bleeker, Nat. Tijdschr. Ned. Ind. VI. 1854, p. 376.
Syngnathus spicifer Kaup, Cat. Lophobr. Fish, 1856, p. 34 (p. p.).
?*Microphis tenuis* Blyth, Proc. Asiat. Soc. Bengal (1858) 1859, p. 272.
Syngnathus Hunnii Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Achtste Bijdr. vischfauna Sumatra, p. 70.
Syngnathus argyrostictus Day, Fishes of Malabar, 1865, p. 264 (nec KAUP).
Syngnathus spicifer Peters, Monatsber. Akad. Berlin, 1869, p. 276.
Syngnathus spicifer Duméril, Hist. nat. Poissons II. 1870, p. 546.
Syngnathus tapeinosoma Duméril, l. c. p. 548.
Syngnathus Hunnii Duméril, l. c. p. 548.
Syngnathus tapeinosoma Günther, Cat. Brit. Mus. VIII. 1870, p. 172.
Syngnathus Hunnii Günther, l. c. p. 172.
Syngnathus spicifer Günther, l. c. p. 172 (p. p.).
Syngnathus spicifer Klunzinger, Abhandl. zool.-bot. Gesellsch. Wien, XXI. 1871, p. 650.
Syngnathus tapeinosoma (?) Klunzinger, l. c. p. 651.
Syngnathus spicifer Day, Fishes of India, 4°. 1878—1888, p. 678 (p. p.).
Syngnathus gracilis Steindachner, Abhandl. Senckenb. naturf. Gesellsch. XXV. 1901, p. 458.
Corythroichthys spicifer Jordan & Seale, Bull. Bur. of Fisheries Wash. XXVI. (1906) 1907, p. 9.
Syngnathus spicifer Max Weber, Nova Guinea V. Zool. Livr. 2, 1908, p. 228.
Syngnathus spicifer Duncker, Spolia Zeylanica VII. 1910, p. 32 (p. p.).
Syngnathus spicifer Günther, Fische d. Südsee, 1910, p. 429 (p. p.).
Syngnathus spicifer Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 79.

D. 25—31; A. 2—3; P. 14—18; C. 10; Rings 14—16+37—42; subdorsal rings: 2nd or 3rd—7th or 9th caudal ring.

Very slender. Trunk heptagonal, tail tetragonal. Shields with transverse lines. Edges of shields more or less prominent, smooth or slightly crenulated, those on the superior lateral shields with a prominent longitudinal keel, continued on the intermedial shields, which are transversely elongated. End of median cristae of trunk strongly deflected on last ring of trunk and first ring of tail to inferior cristae of tail but not united with them. Superior cristae of tail reaching to 2nd or first ring of tail and here deflected to median cristae, but not coalescing with them. Head about 7—10 times in length, low but slightly and very gently gaining in height from point of snout to occiput, which is only slightly lower than highest part of trunk. Occiput with more or less rough transverse lines. Snout longer or much longer (but less than twice) than postorbital part of head [1]), slender, more or less concave, compressed, with a smooth low median keel getting lower on front, from where it may be continued on occiput and nape, gaining in size. Operculum with a complete longitudinal keel from which radiate dorsally and ventrally numerous conspicuous oblique lines. Eye about 6—7 times in head. Tail more than twice, but less than thrice, longer than trunk. Dorsal inserted exclusively on tail, in most cases on the second to the seventh ring. Grayish brown or greenish. Trunk ventrally with 13—15 narrow white cross-bars, separated on the corresponding rings by much broader black cross-bars. Operculum with or without black lines or patches. Snout ventrally with black points and markings. All the specimens without the black and white cross-bars on trunk, but with a dark cross-band between the neighbouring rings, have on the tail, far distant from each other, 5—6 white cross-bands. Length 154 mm. [A specimen of *S. gastrotaenia* Blkr. of BLEEKER's collection seen by us as also of *S. Hunni* Blkr. and a young specimen of *S. tapeinosoma* Blkr. of BLEEKER's collection in the Leiden Museum].

Habitat: Singapore; Sumatra (Samangka Bay, fresh water); Simalur!; Java (Anjer); Celebes (Makassar, Paré Paré!, River near Balangnipa!); Island Kajoa; Buru; Ambon; Ternate;

1) STEINDACHNER calls it in his *S. gracilis* somewhat shorter than postorbital part of head, but in his figure it is drawn as considerably longer.

Ceram (Kairatu!); Halmahera; New Guinea (Doreh; river Klipong! brackish water; British New Guinea). — Red Sea; Zanzibar; Madagascar; Seychelles; Andamans; British India; Malacca; Philippines; China; Pelew Islands; Caroline Islands; Bismarck Archipelago.

In sea near shore, in brackish water of estuaries and in fresh water of rivers and brooks.

3. Syngnathus argyrostictus Kp.

Syngnathus penicillus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1368 (based on a mutilated specimen).
Syngnathus argyrostictus Kaup, Cat. Lophobr. Fish, 1856, p. 33 and p. 46, note.
Syngnathus biserialis Kaup, l. c. p. 33.
Corythoichthys penicillus Bleeker, Versl. Akad. Amsterdam XII. 1861, p. 69 (name only).
Syngnathus argyrostictus Duméril, Hist. nat. Poissons II. 1870, p. 545.
Syngnathus penicillus Duméril, l. c. p. 549.
Syngnathus penicillus Günther, Cat. Brit. Mus. VIII. 1870, p. 171.
Syngnathus spicifer Günther, l. c. p. 172 (p. p.).
Syngnathus spicifer Günther, Fische d. Südsee, 1910, p. 429 (p. p.).
Syngnathus argyrostictus Duncker, Spolia Zeylanica vol. VII. prt. XXV. 1910, p. 32.
Corythroichthys quinquarius Snyder, Proc. U. S. Nat. Mus. Washington XL. 1911, p. 526 and vol. XLII, 1912, p. 408.
Syngnathus argyrostictus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 84.

D. 25—29; A. 3—4; P. 14—17; C. 10; Rings 15—17+37—41; subdorsal rings: 1st—5th or 2nd—6th or 7th caudal ring.

Slender. Shields with the edges smooth but prominent, especially the ventral keel. Intermedial shields, especially the lateral ones, large, oval, radially striated. Median cristae of trunk and superior cristae of tail subcontinuous; they are incompletely interrupted between the last body- and the first tail-ring. Head long and slender, without spines or serrations. Snout with a median keel, longer than remaining part of head, nearly equal to distance from frontborder of eye to base of pectorals. A prominent supraorbital crest and a low occipito-nuchal one. Operculum with a more or less complete longitudinal keel. Caudal small. Colour brownish. Sides of body with 7 more or less conspicuous longitudinal series of pearly ocelli with a dark margin. Tail variegated with brown and whitish. Operculum with 1—3 parallel light stripes in its ventral half. A broad dark band from snout to eye; there may be rows of small spots below it. Length 136 mm. [Not seen by us].

Habitat: Java. — Malay Peninsula; Pinang; Formosa; Japan; South of China.

4. Syngnathus fasciolatus Dum.

Corythoichthys fasciculatus Kaup, Arch. f. Naturgesch. XIX. 1. 1853, p. 231 (no description).
Corythöichthys gastrotaenia Kaup, Cat. Lophobr. Fish, 1856, p. 27 (nec *Syngnathus gastrotaenia* Blkr.).
Syngnathus fasciolatus Duméril, Hist. nat. Poissons II. 1870, p. 561.
Syngnathus fasciolatus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 86.

D. 30 (29) [1]); P. 16 (17); C. 10; Rings 17 + 41 (16 + 40); subdorsal rings 2 + 5.

Shields with the edges, especially the dorsal ones, serrated. Median cristae of trunk reach to last ring of trunk and are subcontinuous with the superior cristae of tail. Head 10 times in total length. Eyes large, the orbits rise suddenly and are closely pressed together so that the forehead is very narrow. Snout short, thick, equal to postorbital part of head, thrice the diameter of the eye; it carries laterally on its upper profile irregular rows of small spines. The conspicuous occipito-nuchal crest divided in three portions and finely denticulated; similar denticulations round the orbits and on the keel running from the orbits to the occiput. Operculum roundish, bulging, rough and divided into two dissimilar parts by a prominent keel. Tail twice the length of the trunk. Colour brown, with a yellowish brown crossbar and speckling on each ring. Length of the single specimen known 80 mm. [Not seen by us].

Habitat: Java (according to KAUP (1853) and to DUMÉRIL), whence it came by KUHL & VAN HASSELT in the Museum at Paris. Evidently by mistake, KAUP states later on (1856), about the same specimen, that it was found at Wahai on Ceram [2]).

5. Syngnathus cyanospilus Blkr.

Syngnathus cyanospilos Bleeker, Nat. Tijdschr. Ned. Ind. VI. 1854, p. 114.
Syngnathus Mossambicus Peters, Monatsber. Akad. Berlin 1855, p. 465.
Syngnathus Kuhlii Kaup, Cat. Lophobr. Fish, 1856, p. 34.

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1) The numbers in brackets are those given by KAUP from the same specimen — the only one known — in the Museum at Paris.

2) KAUP writes "found at Wahai and Ceram in the North Pacific"; this is erroneous: for Wahai lies on the north coast of Ceram, which is an island in the Indian Archipelago.

Syngnathus mossambicus Günther, Fishes of Zanzibar 1866, p. 140.
Syngnathus cyanospilus Günther, Cat. Brit. Mus. VIII. 1870, p. 170.
Syngnathus Kuhlii Duméril, Hist. nat. Poissons II. 1870, p. 555.
Syngnathus cyanospilos Duméril, l. c. p. 555.
Syngnathus mossambicus Duméril, l. c. p. 565.
Syngnathus cyanospilos Day, Fishes of India 4° 1878—1880, p. 678.
Doryichthys spaniaspis Jordan & Seale, Bull. Bur. of Fisheries Washington XXVI. (1906) 1907, p. 10.
Syngnathus cyanospilos Max Weber, Siboga-Exped. Fische. 1913, p. 107.
Syngnathus cyanospilus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 81.

D. 21—25; A. 2—3; P. 12—16; C. 10; Rings 13—14+32—36; subdorsal rings 1 + 4—5.

Elongated; trunk heptagonal, the ventral crista very high; tail tetragonal, about $2^1/_2$ times longer than trunk. Shields transversely striated; their edges smooth or slightly crenulated. Median cristae of trunk, deflected on the last trunk-ring to inferior cristae of tail, which they nearly reach, but with which they do not coalesce. Superior cristae of trunk reaching to about middle of dorsal; anterior end of superior cristae of tail reaches nearly to commencement of dorsal. Head $7^1/_2$—$8^1/_2$ times in length, low, its rostro-frontal profile somewhat concave. Front and vertex transversely striated. Snout somewhat longer than postorbital part of head, with a median rather high keel, running to concave interorbital space. A scalloped nuchal crest beginning on vertex and reaching to first body-ring. Operculum inflated, with a conspicuous longitudinal keel, which is complete or nearly so [1]); from it radiate fine striae. Caudal shorter than postorbital part of head. Brown, trunk laterally with dark transverse bars on the limits of the rings; tail with numerous irregular whitish spots, which are blue in life. Dorsal with black oblique streaks. Ventral crista blackish. Length 152 mm. [Specimens of BLEEKER in the Leiden Museum seen by us].

Habitat: Singapore!; Nias!; Java; Banda; Ternate; Island Siau!. — Gulf of Suez; Mossambique; Zanzibar; Madagascar; British India; Philippines; Formosa.

6. **Syngnathus (?) uncinatus** M. Web. [2]). [Fig. 35, p. 85].

Syngnathus uncinatus M. Weber, Siboga-Expeditie, Fische 1913, p. 110.

1) In a young specimen of 92 mm. length, this keel is very short and rather low.
2) We are not sure about the *generic* position of the single young specimen we possess.

Syngnathus(?) *uncinatus* Duncker, Mitt. a. d. naturh. Mus. Hamburg, XXXII. 1915, p. 86.

D. 28; P. 15; Rings 15 + 42; subdorsal rings 1 + 7.

Slender. Trunk heptagonal, the ventral keels strongly prominent; tail tetragonal. Shields transversely striated, their edges strongly prominent, finely but very sharply serrated, terminating in a hindward curved spine. Intermedial shields (scutella) wanting. Superior cristae of trunk terminating near end of dorsal; superior cristae of tail with their anterior part deflected and continued to last ring of trunk; where they are situated above the end of the median cristae of trunk. Inferior cristae of trunk and tail continuous. Head $8^1/_2$ times in length, twice in that of trunk. Snout equal to remaining part of head, thrice longer than diameter of eye; it is cylindrical but somewhat compressed; its superior profile obliquely continued in that of the posterior part of the head. A median denticulated keel begins on the posterior half of the snout and is continued with two intervals on the occiput and nape; serrated supraorbital edges commence before the nostrils and terminate on occiput. Similar edges laterally on snout. Operculum with a complete serrated longitudinal keel from which radiate pennatiform edges. Tail more than $2^1/_2$ times as long as trunk. Subdorsal rings inflated; dorsal fin therefore somewhat elevated above level of dorsal profile. Caudal rounded, much shorter than postorbital part of head. Yellowish, ventral part of trunk brown as also

Fig. 35.
Syngnathus uncinatus M. Web.
× 3.7.

a longitudinal patch below dorsal and the lateral part of the tail, which shows about 6 light crossbars, hindwards diminishing in breadth. Length of the single specimen known 60 mm.

Habitat: Banda, on reef!

Fig. 36.
Syngnathus punctatus M. Web.
× 2.5.

7. **Syngnathus punctatus** M. Web. [Fig. 36, p. 86].

Syngnathus punctatus Max Weber, Siboga-Expeditie, Fische. 1913, p. 113.

D. 23; P. 16; Rings 15 + 30; subdorsal rings 1 + 5.

Rather robust. Trunk heptagonal, the ventral keel conspicuous. Tail tetragonal, somewhat less than twice the length of the trunk. Shields transversely striated and corrugated, their edges prominent but smooth. Intermedial shields oval, very conspicuous. Superior cristae of trunk terminating about in the middle of the dorsal, not continuous with those of tail, which are deflected anteriorly and terminate on the first tail-ring, quite near the termination of the median cristae of the trunk. Inferior cristae of trunk and tail continuous. Head somewhat more than $6^1/_2$ times in length, twice in that of trunk. Snout conspicuously longer than remaining part of head; its least height is less than diameter of eye, it is cylindrical, its upper somewhat concave profile gently rises to that of head. A low median keel on posterior half of snout ending in the narrow concave interorbital space. Top of head corrugated with an indication of a median keel and a more conspicuous one on nape and behind eyes. Operculum strongly inflated with a short keel, which is somewhat curved

upward [1]) and from which radiate numerous lines and series of points. Base of dorsal not elevated. Anal and caudal very small. Yellowish with a faint brownish marmoration. Length of the single specimen known 79 mm.

Habitat: Sumbawa, 36 M., on sand and coral bottom!

8. Syngnathus pelagicus L.

Syngnathus pelagicus Linné, Syst. nat. ed. X. 1758, p. 337.
Syngnathus pelagicus Kaup, Cat. Lophobr. Fish, 1856, p. 36.
Syngnathus pelagicus Duméril, Hist. nat. Poiss. II, 1870, p. 560.
Syngnathus pelagicus Günther, Cat. Brit. Mus. VIII. 1870, p. 165.

D. 29 (29—31)[2]); P. 13 (13—14); A. 4; C. 10; Rings 17 + 32 (17+32—35); Subdorsal rings 2+6 (1+6).

Rather slender, trunk heptagonal, tail tetragonal. Rings transversely striated, their edges pronounced but smooth. Superior cristae of trunk and tail discontinuous; inferior cristae of trunk and tail continuous. Median cristae of trunk terminate at the end of last trunkring; the superior cristae of tail begin, quite near them, on the first tailring: both are therefore subcontinuous. Head 6.6 in total length, about twice in trunk and one quarter longer than base of dorsal. Eye more than 6 times in head and about thrice in snout. Snout about equal to remaining part of head, somewhat compressed, with a median crest ending about in the middle of the concave interorbital space and with a lateral crest ending in orbital ring, which is prominent but smooth. Occiput somewhat concave but corrugated; praenuchal and nuchal shield corrugated and with a median keel. Operculum somewhat inflated with a short basal keel, whereof radiate numerous fine striae, their intervals punctured. Base of dorsal not elevated; caudal nearly twice as long as eye. Brown, with a faint silvery transverse bar on the trunkrings; on the tail a light transverse bar on each third ring; dorsal with rather broad, oblique brown bands. Length 143 mm.

Habitat: Celebes!; Moluccos(?). — Malacca Straits, China,

1) This is somewhat too strongly accentuated in our figure.

2) The numbers in brackets are those given by DUMÉRIL and GÜNTHER; our diagnosis is made after a single specimen in the Leiden Museum, collected by VAN DEI.DEN in Celebes. We have also some specimens in the Amsterdam Museum at our disposition given by VAN DER HUGT and said to be collected in the Moluccos, but we are not absolutely sure, that this was really the case. We are not free from the impression, that this collector, as in olden times often was the case, also collected on his homeward voyage round the Cape of Good Hope.

South Australia, New Zealand, Falkland Islands, Mauritius, Réunion, Cape of Good Hope, Tropical Atlantic, Brazil, West Indies, Mediterranean.

This species was first described from East India, from open sea in floating seaweed, by Osbeck (Dagbok Resa Ostindien 1757, p. 305).

9. **Syngnathus acus** L. [1]). [Fig. 37, p. 89].

Syngnathus acus Linné, Syst. nat. ed. X. 1758, p, 337.
Syngnathus acus Kaup, Cat. Lophobr. Fish, 1856, p. 41.
Syngnathus brachyrhynchus Kaup, ibid. p. 42.
Syngnathus acus Duméril, Hist. Nat. Poissons II. 1870, p. 552.
Syngnathus brachyrhynchus Duméril, ibid. p. 554.
Syngnathus acus Günther, Cat. Brit. Mus. VIII. 1870, p. 157.
Syngnathus acus Sauvage, Hist. nat. Poiss. Madagascar 1891, p. 506.
Syngnathus acus Jatzow & Lenz, Abh. Senckenb. naturf. Gesellsch. XXI. 1899, p. 529.

D. 35—45; P. 12—14; A. 4; C. 10; Rings 18—19 + 38—44; subdorsal rings 1 + 7—11 or 2 + 8.

Trunk heptagonal, sometimes much deeper than head, abdominal keel more or less pronounced; tail quadrangular. Shields transversely striated, their edges conspicuous but smooth, intermedial shields smooth. Superior cristae of trunk and tail discontinuous, inferior cristae of trunk and tail continuous. Median cristae of trunk and superior cristae of tail continuous or nearly so, the former reaching to hindborder of last trunk ring, the latter beginning slightly above it at the frontborder of the first tailring. Head about $6^1/_2$ to nearly 8 times in total length, more or less than twice in trunk. Upper and lateral surface of head strongly corrugated, occiput elevated on its posterior border and provided with a low median keel, which is continued on the strongly corrugated praenuchal and nuchal shield. Eye somewhat more than 8 to 9 times in head, more or less than 5 times in snout. Snout 1.5 to less than twice in length of head; it is equal to distance from frontborder of eye to base or middle or even end of pectorals; postorbital space 1.7 to 2.8 times in snout. Snout with a sharp median keel, smooth, in older specimens slightly serrated, reaching to inter-

1) We believe that *Syngnathus Schlegeli* Kaup (Cat. Lophobr. Fish, 1856, p. 46) is identical with *S. acus* L., but we presume that there are small racial differences in the slenderness of the body, the length of the snout, the subcontinuity or continuity of the median cristae of trunk and superior cristae of tail, according to the locality of this widely spread species.

Fig. 37. *Syngnathus acus* L. × 7/8.
After a specimen collected in the Java Sea by P. BUITENDIJK, remarkable for the height of the trunk and for its abdominal crista which is more prominent than usually.

orbital space, which is flat but becomes deeply concave with age. A pair of lateral ridges, also slightly serrated, reach the prominent orbital borders and are continued to the occiput. Operculum with a rectilinear keel in its anterior third, whereof radiate low but conspicuous ridges, especially numerous in the lower half of the operculum and which form a network. Trunk twice to nearly $2^1/_2$ times in tail. Eggpouch extending from last trunkring or 23rd or 25th tailring, its length more or less than $1^2/_3$ in tail. Base of dorsal not elevated, its length equal to or somewhat more or less than length of head. Caudal about twice longer than eye. Brown with darker transverse bands comprising 3 to 4 rings, which are separated by 2 rings of lighter colour and equal to the groundcolour. Length of indo-australian specimens 395 mm.

Habitat: Pulu Weh near Sumatra [1])!; Java (Palabuan ratu!); Java Sea [1])!. — Réunion, Bourbon, Madagascar (?), Zanzibar, Cape of Good Hope, Madeira, Eastern parts of Atlantic, Mediterranean.

Note. We have compared the specimens of *S. acus* from the Archipelago, after which our description is made, with specimens from Holland and are not able to distinguish them.

13. Ichthyocampus Kaup.

(Kaup, Cat. Lophobr. Fish, 1856, p. 29).

Medium sized or small and rather stout. Shields sculptured; the edges more or less prominent, smooth or some of them slightly crenulated or even dentated; there may be split cutaneous appendages. Intermedial shields (scutella) present as also a praenuchal and a nuchal shield. Head only slightly elongated. Snout short, somewhat compressed; its dorsal profile with a median sharp or low ridge. Operculum much higher than long,

1) These specimens are authentical from the said localities; two of the specimens from Java in the Leiden Museum were collected by Kuhl & van Hasselt and are named on their label *Syngnathus varicgatus* K. v. H., a name previously (1811) used by Pallas for specimens of *S. acus* L. from the Black Sea. The other specimens from Java Sea and Pulu Weh were recently collectedby Dr. P. Buitendijk, that from Palabuan ratu, South coast of Java by Major Ouwens. The Amsterdam Museum contains some specimens of the same species given by van der Hugt and said to be collected in the Moluccos. They agree in every detail with the above description, but we are not quite sure about the locality, as we are not free of the suspicion, that van der Hugt collected also on his homeward voyage round the Cape of Good Hope, as often happened in his time.

somewhat inflated, smooth or shagreened without a keel or with a complete or at least a basal keel with radiating lines. Superior cristae of trunk and tail continuous; inferior cristae of trunk and tail discontinuous but the last named continuous with the median cristae of the trunk or the inferior cristae of trunk and tail are continuous in which case the median cristae of trunk end free. All the fins present; dorsal short, inserted on four to six rings, which generally belong for the largest part to the tail; caudal short. Eggs isolated in cutaneous cells on the tail, they are completely enclosed in a brood-pouch formed by lateral folds beginning at anus, which may contain osseous plates.

Distribution: Marine shore-fishes, some of them living also in deeper water and in fresh and brackish water. Red Sea, East Africa, Gulf of Persia, Maladives, Ceylon, Indo-australian Archipelago, China, Riu Kiu Islands, Australia, Hawaii.

Fig. 38. *Ichthyocampus kampeni* M. Web. × 2.9.

Key to the indo-australian species of Ichthyocampus.

1. Median cristae of trunk bent on last ring of trunk to inferior cristae of tail and nearly reaching them or they are united. Rings 14—15+37—40. Operculum with a complete keel . . . . . *I. carce* p. 92.
2. Median cristae of trunk rectilinear, ending at least on 2nd ring of tail. Keel only on anterior third of operculum.
   a. Median cristae of trunk ending in male on third, in female on 16th or 17th tail-ring. Posterior tail-rings with sharp edges increasing in height posteriorly and ending in a sharp tooth. *I. kampeni* [1]) p. 93.

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1) This species is distinguished from *Ichth. belcheri* Kaup from the Red Sea, Zanzibar, China and the Riu Kiu Islands by the following characters: in *I. belcheri* the median cristae of the trunk end in both sexes on the 2nd or 3rd tail-ring and the posterior rings of the tail are not distinguished by sharp

b. Median cristae of trunk ending in both sexes on 2nd or 3rd tail-ring. Edges of rings in posterior part of tail posteriorly without a sharp tooth . . . . . *I. belcheri* (not known from the Archipelago).

1. Ichthyocampus carce (Ham. Buch.).

Syngnathus carce Hamilton Buchanan, Fishes of the Ganges 1822, p. 13.
Hippichthys heptagonus Bleeker, Verhand. Batav. Genootsch. XXII. 1849, Bijdr. Ichth. fauna Madura, p. 15 [1]).
Syngnathus carce Bleeker, Verhand. Batav. Genootsch. XXV. 1853, Bijdr. Troskieuwige Visschen p. 161.
Syngnathus heptagonus Bleeker, Nat. Tijdschr. Ned. Ind. IX. 1855, p. 430.
Ichthyocampus carce Kaup, Cat. Lophobr. Fish, 1856, p. 30.
Ichthyocampus ponticerianus Kaup, l. c. p. 31.
Ichthyocampus carce Bleeker, Act. Soc. Sc. Ind.-Neerl. VIII. 1860, Achtste Bijdr. vischfauna Sumatra, p. 71 (name only).
Ichthyocampus ponticerianus Day, Fishes of Malabar 1865, p. 263.
Ichthyocampus pondicerianus Kner, Novara-Exp. Fische, 1865—1867, p. 391.
Ichthyocampus ponticerianus Duméril, Hist. nat. Poissons II. 1870, p. 540.
Ichthyocampus carce Duméril, l. c. p. 540.
Syngnathus heptagonus Duméril, l. c. p. 548.
Ichthyocampus carce Günther. Cat. Brit. Mus. VIII. 1870, p. 176.
Ichthyocampus carce Day, Fishes of India 4° 1878—1888, p. 679.
Ichthyocampus carce Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 94.
Ichthyocampus carce Chaudhuri, Mem. Indian Museum V. 1916, p. 456.

D. 23—27; A. 2—3; P. 13—17; C. 9—11; Rings 14—15 + 37—40; subdorsal rings: from the 2nd or 3rd to the 7th or 9th tail-ring.

Body compressed, heptagonal; the abdominal cristae sharp and strongly prominent. Tail tetragonal, more than twice as long as trunk. Shields transversely striated, their edges pro-

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edges increasing in height posteriorly and ending in a sharp tooth. We draw attention to this fact also on account of the following reasons. In the first place because DUNCKER erroneously unites *I. kampeni* M. Web. with *I. belcheri* Kaup (see also note on p. 94); in the second place because KAUP (Cat. Lophobr. fish, p. 30) says, that in the Leiden Museum are specimens of *I. belcheri* Kaup brought from Borneo by Dr. MÜLLER. At present that Museum contains of Syngnathidae brought by S. MÜLLER from Borneo only *Doryichthys spinosus* Kaup = *Microphis boaja* Blkr. and *Syngnathus micrognathus* K. & v. H. (Museum name!) = *Coelonotus liaspis* (Blkr.). We presume that *I. belcheri* Kaup is a species not represented in the indo-australian Archipelago but confined to the shore waters of continental Asia and Japan.

1) See about this species the remarks of GÜNTHER (Cat. Brit. Mus. VIII. 1870, p. 173).

minent, smooth or only slightly crenulated. Inferior cristae of trunk and tail generally continuous, when this is the case the median cristae of trunk are deflected to the inferior cristae of the tail without coalescing with them; by exception the inferior cristae are not continuous and then the median cristae of the trunk are continuous with the inferior cristae of the tail. Lateral intermedial shields, especially on the tail, large and transversely oblong; cutaneous appendages are wanting. Head 9—9$^1/_2$ times in length with a median ridge continued on snout; front and vertex more or less rough by lines or shagreen. Eye 5—6 times in head. Snout equal to or somewhat longer than postorbital part of head, about twice longer than eye. Operculum inflated, with a complete longitudinal keel and radially arranged rugosities or radiating lines. Brown, a white spot or a white black-margined ocellus on each trunk-ring along the inferior cristae; ventral surface of tail occasionally with alternating brown and yellow dots; ventral surface of snout and head with black points; caudal black. Length 138 mm. [A specimen of *Syngnathus heptagonus* Blkr. of BLEEKER's collection in the Leiden Museum seen by us].

Nom. indig.: Sogoprono (Patjitan).

Habitat: Java (Patjitan, Surabaya); Straat Madura; Bali; Celebes (Makassar); Sumatra (Benkulen). — British India, Ceylon, Assam, Nicobars, Malay Peninsula.

In sea, in brackish water of estuaries and in fresh water of rivers and brooks.

2. **Ichthyocampus kampeni** M. Web. [Fig. 38, p. 91].

Ichthyocampus Kampeni Max Weber, Siboga-Expeditie, Fische 1913, p. 114.
Ichthyocampus Belcheri Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 95 (p. p.).

D. 19—20; A. 3; P. 12—13; C. 10; Rings 16+29—30; subdorsal rings 1+4—5 or 2+3—4.

Rather stout and short; body somewhat heptagonal, the abdominal crista being only slightly prominent. Tail from the 2nd or 3rd ring tetragonal, somewhat shorter than twice the length of the trunk. Shields corrugated; their edges prominent, smooth; especially on the posterior part of the tail they are sharp, on each ring increasing posteriorly in height and ending in a sharp prominent tooth. No cutaneous appendages. Superior and inferior cristae of trunk continuous with the corresponding

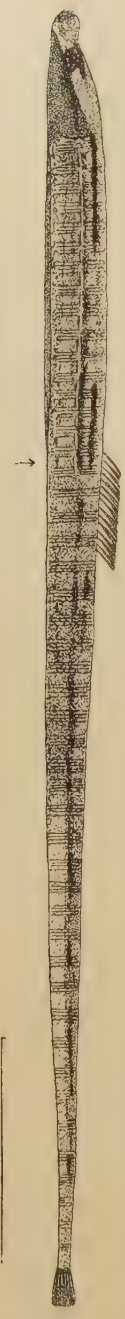

Fig. 39. *Nannocampus weberi* Duncker. × 3.

cristae of tail; median cristae of trunk rectilinear, ending in the male on the 3rd tail-ring; in the female on the end of the 16th or the anterior half of the 17th tail-ring [1]). Head nearly 8 times in length and more than twice in trunk. Snout about equal to postorbital part of head and twice the length of the diameter of eye. It rises gently and obliquely to the front, is in its lowest part about as high as diameter of eye, has the dorsal profile slightly concave, and has a median keel ending on interorbital space. There are traces of a keel on occiput and nape and of feeble supra-orbital ridges. Operculum with a keel on anterior third, from which radiate faint lines. Length of caudal equal to that of eye. Lighter or darker brown. Ventral surface with lighter or darker cross-bars, corresponding to the rings, especially on trunk, where these cross-bars are also extended on the sides. Dorsal surface with more or less conspicuous dark bands, far distant from each other. Length 58 mm.

Habitat: Island Karakelang!; Island Salibabu!; Ambon!; West coast of New Guinea!.

On coral reefs.

14. Nannocampus Günther.

(Günther, Cat. Brit. Mus. VIII. 1870, p. 178).

Body rather short; tail equal to or longer than head and trunk. Shields with transverse lines, their edges obsolete; intermedial shields (scutella) large, oval. Superior, and as far as known also the inferior cristae of trunk and tail continuous; median cristae of trunk rectilinear, ending below dorsal. Head short, without ridges, finely granulated. Snout extremely short, about equal to diameter of eye, thick. Operculum without keel;

1) We had occasion to state this arrangement which is very conspicuous and the correctness of which was doubted by Duncker in four female and 4 male specimens of 4 different localities.

pectorals none; dorsal short; caudal very small. Egg-pouch on the tail formed by cutaneous folds from the lower edges of the tail with or without osseous plates.

Distribution: The species of this genus found near shore in Australia, the indo-australian Archipelago and the Bahamas are insufficiently known.

1. **Nannocampus weberi** Duncker [Fig. 39, p. 94].

Nannocampus subosseus Max Weber, Siboga-Exp. Fische 1913, p. 115 (nec GÜNTHER).

Nannocampus Weberi Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 99.

D. 16—17; Rings 16+32; subdorsal rings 1+4.

Shields with few conspicuous transverse lines, their edges rounded. Intermedial shields very large, oval. Tail $2^1/_2$ times as long as trunk. Inferior cristae of trunk and tail continuous; median cristae of trunk rectilinear, ending on last ring of trunk. Head more than 10 times in length, $2^1/_2$ times in trunk. Snout extremely short, as long as diameter of eye and half as long as postorbital part of head, thick, compressed, its dorsal profile concave, mesially with the trace of a ridge, which divides before the eyes into 2 low ridges continued on the upper outer border of the orbits. Operculum without a keel, its surface as also that of the entire head shagreened. Light brown with indistinct irregular longitudinal blackish bands. Length of the single (female?) specimen known 57 mm.

Habitat: Island Sumba (Bay of Malé Kaba, on reef!).

Note. We are not sure that this species is different from *N. subosseus* Günther from West Australia but the lastnamed species is as yet represented only by a dried male specimen in the British Museum and not in a state that the fin-rays could be counted and the end of the median cristae ascertained.

15. **Penetopteryx** Lunel.

(LUNEL, Mém. Soc. Phys. hist. nat. Genève XXVII. 1881, p. 275).
Apterygocampus Max Weber, Siboga-Exp. Fische 1913, p. 115.

Small, elongated; as all the edges are obtuse the body is somewhat rounded and the trunk only feebly hexa- or heptagonal, the tail tetragonal. Superior and inferior cristae of trunk and tail continuous; median cristae of trunk reaching to end

of trunk. Shields transversely striated; intermedial shields (scutella) large, oval. Head very small without ridges. Snout extremely small. Operculum without keel. Caudal rudimentary, all the other fins are wanting. Trunk short, at least twice as short as tail. Eggs in a brood-pouch on the anterior part of the tail formed by cutaneous folds beginning at the anus and united mesially.

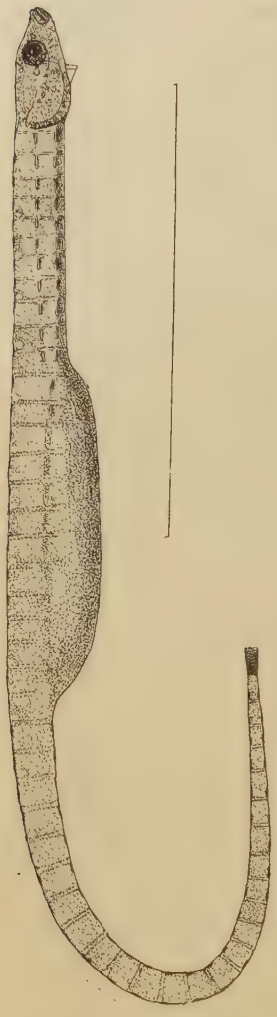

Fig. 40. *Penetopteryx epinnulatus* (M. Web.). × 6.

Distribution: There are only 2 species known: one from Mauritius, the other from the island Gisser near Ceram. They are marine fishes living near shore.

1. **Penetopteryx epinnulatus** (M. Web.)

[Fig. 40, p. 96].

Apterygocampus epinnulatus Max Weber, Siboga-Exp. Fische. 1913, p. 116.
Penetopteryx epinnulatus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 102.

Rings 12 + 38.

Body nearly rounded. Trunk feebly hexagonal as all the cristae are only indicated by a short edge on the anterior part of the rings. Superior and inferior cristae of trunk and tail continuous; median cristae of trunk ending on the 11th ring of trunk. Tail feebly four-sided, 4 times longer than trunk. Head $11^1/_2$ times in length, 2 times in trunk, it is somewhat rounded, all edges wanting. Snout extremely short, rounded, thick, half as long as post-orbital part of head, dorsally slightly concave and obliquely rising to the front. Eye nearly 5 times in head. Operculum without a keel, caudal rudimentary. Yellowish with a white spot on each 2nd ring; white spots and rings in bands between eyes, below them and on

operculum. Length of the single specimen known, a male with an egg-pouch, 29 mm.

Habitat: Island Gisser, West of Ceram, on reef!.

16. Stigmatophora Kaup.

(Kaup, Cat. Lophobr. Fish, 1856, p. 52 [1]).

Body subcylindrical, scarcely broader than deep or strongly depressed and very broad; the lateral shields being very oblique and produced into sharp edges, which form the median cristae of the trunk and border the flat abdominal surface; otherwise the edges are obsolete. Superior and inferior cristae of trunk united with the corresponding cristae of the tail. Tail long, without caudal, ending filiform but not prehensile. A praenuchal and two nuchal shields present. Head not elevated, produced into a long snout of nearly equal height as head, more or less than twice the length of the remaining part of the head. Eyes large. Operculum without a longitudinal keel or with a basal or a complete one. Dorsal long or very long, its middle above or somewhat before or behind anus. Anal small; pectorals well developed. Eggs large, isolated in cutaneous cells on the lower surface of the tail, enclosed in a completely closed brood-pouch formed by a pair of lateral cutaneous folds beginning behind vent. The sexes may be strongly dimorphic.

Distribution: New Guinea, Australia, Tasmania, New Zealand.

1. Stigmatophora argus (Rich.).

Syngnathus argus Richardson, Proc. Zool. Soc. London 1840, p. 29. — Trans. Zool. Soc. London III. prt. 2, 1849, p. 183.
Solegnathus argus Bleeker, Verhand. Akad. Amsterdam II. 1855, p. 17 (name only).
Stigmatophora Argus Kaup, Cat. Lophobr. Fish, 1856, p. 53.
Stigmatophora argus Duméril, Hist. nat. Poissons II. 1870, p. 583.
Stigmatophora argus Günther, Cat. Brit. Mus. VIII. 1870, p. 189.
Gastrotokeus gracilis Klunzinger, Arch. f. Naturgesch. XXXVIII. 1. 1872, p. 44.
Stigmatophora argus de Castelnau, Proc. Zool. Soc. Victoria, 1872, p. 243; 1873, p. 77.
Stigmatophora olivacea de Castelnau, l. c. 1872, p. 244; 1873, p. 77 [2]).
Stigmatophora unicolor de Castelnau, Research. on the fishes of Australia 1875, p. 49.

1) It is certainly a misprint when Kaup (Arch. f. Naturgesch. XIX. 1. 1853, p. 233) calls this genus *Stigmatopora*.

2) This species, which Duncker (1915) unites with *St. argus* (Rich.), is according to Ogilby (Mem. Queensl. Mus. I. 1912, p. 36) "certainly valid".

Stigmatophora argus Klunzinger, Sitzber. Akad. Wien LXXX. 1879, p. 420.
Stigmatophora olivacea Macleay, Descript. Cat. Australian Fishes II. 1881, (separ. edit.) p. 234.
Stigmatophora unicolor Macleay, ibid. p. 234.
Stigmatophora depressiuscula Macleay, ibid. p. 235.
Stigmatophora gracilis Macleay, ibid. p. 235.
Stigmatophora argus Johnston, Proc. Roy. Soc. Tasmania, 1882, p. 134.
Stigmatophora argus Lucas, Proc. Roy. Soc. Victoria (2) II. 1890, p. 39.
Stigmatophora argus var. *brevicaudatus* Lucas, l. c. III. 1891, p. 14.
Stigmatophora argus Duncker, in Fauna Südwest Australiens II. Pisces, 1909, p. 239. — Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 103.
Stigmatopora argus McCulloch, Check-list of the Fish of N. S. Wales, 1919, p. 27.
Stigmatophora argus Waite & Hale, Rec. South Austral. Mus. I, 1921, p. 308.

D. 43—55; A. 2—4; P. 14—17; Rings 17—20+73—89 [when complete]; subdorsal rings 7—10+8—12.

Head $5^1/_2$—6 times in length. Snout equal to or somewhat shorter than remaining part of head; it has a median ridge. Eye about 12 times in head. Operculum with a feeble longitudinal keel in young specimens, disappearing in old. Trunk more than twice but less than thrice shorter than tail. Shields corrugated. Median cristae of trunk ending behind dorsal on the 10th to 14th tail-ring. Brown or grayish above, lighter below; female on each side with a dorsal series and four more or less alternating series of black white-edged ocelli on trunk and anterior part of tail; male dorsally with a double series of ocelli, the other ones faint or wanting. Length 205 mm. [Only an old, much mutilated specimen in the Leiden Museum seen by us].

Habitat: New Guinea (Duméril, Günther, Bleeker). — Coasts of Australia and Tasmania.

17. Trachyrhamphus Kaup.

(Kaup, Cat. Lophobr. Fish, 1856, p. 23).

Much elongated; trunk heptagonal; tail tetragonal, much longer than trunk. Shields transversely rugose, their edges smooth, not much prominent; intermedial shields (scutella) oval; a praenuchal and two nuchal shields present. Superior and inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. Head with the eyes and front prominent, forming an angle with the snout, which has a serrated keel. Operculum with a basal convex keel directed upwards and with fine radiating lines. All the fins developed, caudal small; dorsal on an elevated base inserted

on about 6 rings, its middle nearly above the anus. Eggs very small and numerous, isolated in cutaneous cells on the tail, protected by lateral cutaneous folds, which begin behind anus, diverge hindwards and form a brood-pouch mesially not closed.

Distribution: Only a single species known, living in sea along the coasts from British India to Japan.

1. Trachyrhamphus serratus (Schl.). [Fig. 41, p. 99].

Syngnathus serratus Schlegel, Fauna japonica, Poiss. 1847, p. 272.
Syngnathus serratus Bleeker, Verhand. Batav. Genootsch. XXV. 1853, Nalezingen Ichth. Japan, p. 55.
Trachyrhamphus serratus Kaup, Cat. Lophobr. Fish, 1856, p. 23.
Trachyrhamphus cultrirostris Peters, Monatsber. Akad. Berlin (1869) 1870, p. 710.
Trachyrhamphus serratus Duméril, Hist. nat. Poissons II. 1870, p. 538.
Trachyrhamphus cultrirostris Duméril, l.c. p. 539.
Syngnathus serratus Day, Fishes of India 4°, 1878—1888, p. 677.
Trachyrhamphus serratus Jordan & Snyder, Proc. U. S. Nat. Mus. Wash. XXIV. 1901, p. 9.
Syngnathus serratus Duncker, Mitt. a. d. naturh. Mus. Hamburg XXI. 1904, p. 188.
Trachyrhamphus serratus Duncker, in: Spolia Zeylanica Vol. VII: Prt. XXV. 1910, p. 30. — l. c. XXXII. 1915, p. 105

D. 25—29; A. 3—4; P. 14—19; C. 8—10; Rings 21—23+44—50; subdorsal rings 2—4+2—3.

Head about 14 times in length, 4—5 times in trunk. Eye large, 6 times in head; orbits projecting

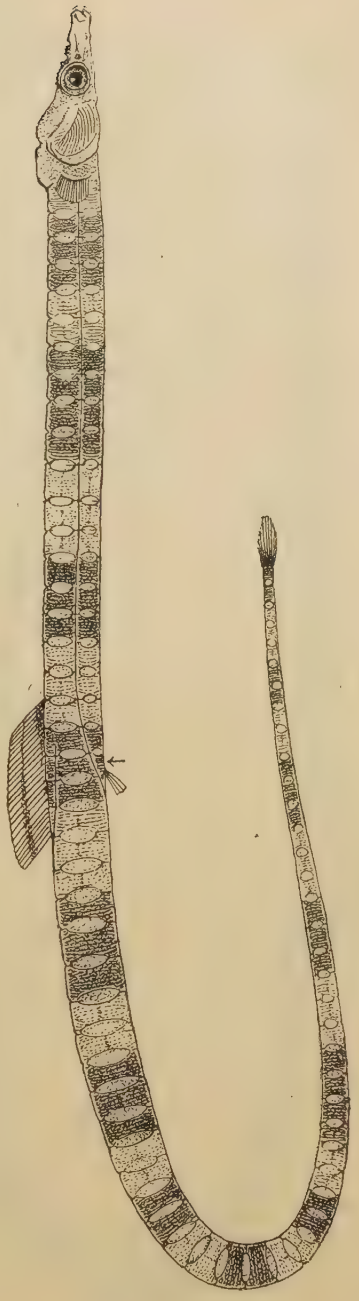

Fig. 41.
Trachyrhamphus serratus (Schl.). × 6/5. After an old specimen, in the Leiden Museum, in which the cutaneous appendages were lost,

Fig. 42. *Yozia bicoarctata* (Blkr.). × 4/3. After specimen of Bleeker, in which the colour was faded.

with prominent edges. Interorbital space broad, a median ridge on occiput and nape. Snout slender, compressed, with a spiny median crest more than twice longer than eye, equal to or somewhat more or less than postorbital part of head. Split cutaneous appendages mesially on back and on the median cristae of trunk. Caudal very small. Brown with 9—12 broad, dark, diffuse crossbands and with light spots along the side or dark brown variegated; below operculum with darkish bands. Length 303 mm. For other characters see those of the genus. [No specimen from the indo-australian region seen by us].

Habitat: Singapore (Duncker 1904). — British India, Ceylon, Siam, China, Japan!.

18. **Yozia** Jordan & Snyder.

(Jordan & Snyder, Proc. U. S. Nat. Mus. Wash. XXIX. 1901, p. 4).

Slender, elongated. Trunk short, in the middle of its length more or less swollen. Shields transversely striated, their edges rounded and smooth or more pronounced and feebly granulated or crenulated; intermedial shields (scutella) oval or angular; a praenuchal and two nuchal shields present. Head not

elevated, gently continued in the long snout, which is compressed and longer than remaining part of head; a median keel is wanting or not, when present, it is low, smooth or with slight serrations, but never spinous. Front and orbits not prominent. Cutaneous appendages may be present. Operculum with a keel, which only is conspicuous at the base and curved upwards, its convexity looking backwards. Superior and inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. All the fins present. Dorsal with its base not or only slightly elevated; its middle above anus; caudal small. Eggs small, numerous, isolated in cutaneous cells on tail and totally enclosed by a subcaudal brood-pouch formed by lateral cutaneous folds beginning behind anus.

Distribution: Marine fishes living along the coasts of East Africa, Mauritius, Cargados Carajos Islands, British India, Ceylon, Indo-australian Archipelago, China, Japan, Torres Straits, Australia.

1. Yozia bicoarctata (Blkr.) [Fig. 42, p. 100].

Syngnathus bicoarctatus Bleeker, Act. Soc. Sc. Indo-Neerl. II. 1857, 8ste Bijdr. vischfauna Amboina, p. 99.
Syngnathus zanzibarensis Günther, in: Playfair & Günther, Fishes of Zanzibar, 1866, p. 140.
Syngnathus bicoarctatus Duméril, Hist. nat. Poissons II. 1870, p. 569.
Syngnathus zanzibarensis Günther, Cat. Brit. Mus. VIII. 1870, p. 168.
Syngnathus bicoarctatus Günther, l. c. p. 176.
Yozia wakanourae Jordan & Snyder, Proc. U. S. Nat. Mus. Wash. XXIV. 1901, p. 8.
Yozia wakanourae Jordan, Tanaka & Snyder, Journ. Coll. Sci. Tokyo XXXIII. 1913, p. 96.
Yozia bicoarctata Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 107.

D. 27—29; A. 4; P. 16—17; C. 7—8; Rings 21—24+59—63; subdorsal rings 3+3—4.

Trunk heptagonal, slightly swollen between the 6th and 13th ring; tail tetragonal, about $2^1/_2$ times as long as trunk. Shields transversely striated, their edges rather obtuse, slightly granular and crenulated or smooth; intermedial shields oval or angular, granular. No cutaneous appendages. Head 10—12 times in length, more or less than $2^1/_2$ times in trunk. Occiput rough, somewhat prominent, without being raised into a ridge, other ridges also wanting. Eye 6—7 times in head. Snout slender, scarcely compressed; its dorsal edge smooth, less than twice the length of the postorbital part of the head, gently

and slightly rising to broad interorbital space. Operculum swollen with a low somewhat convex longitudinal keel and dorsally and ventrally radiating lines. Caudal very small or rudimentary; base of dorsal not or only slightly elevated. Brown with lighter or darker marblings; trunk ventrally with faint transverse bands, lower surface of tail with irregular transverse margaritaceous spots. Snout and under side of head with large black spots. Length about 300 mm. [Specimen of *S. bicoarctatus* Blkr. of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Singapore; Sumatra; Ampon. — East Africa, Mauritius, Cargados Carajos Islands, China, Japan.

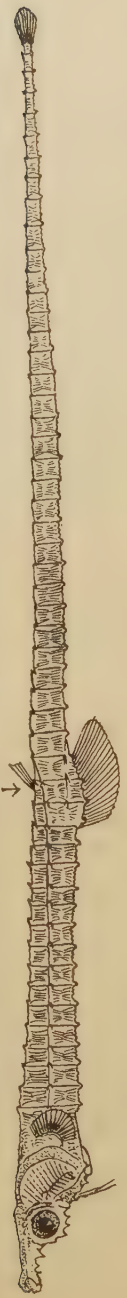

Fig. 43. *Halicamptus koilomatodon* (Blkr.). × 2.
After specimen of BLEEKER from Japan, in which the cutaneous appendages are wanting.

19. Halicampus Kaup.

(KAUP, Cat. Lophobr. Fish, 1856, p. 22).

Elongate, rather stout, trunk heptagonal; tail tetragonal, about twice longer than trunk. Shields with the edges prominent, entire, incompletely divided in two or dentated or serrated and partly spinous, furnished with arborescent cutaneous appendages; intermedial shields (scutella), a praenuchal and a nuchal shield present. Head with prominent eyes. Snout slender, more or less depressed, with rows of small spines, shorter or much longer than remaining part of head, and abruptely ascending to the forehead, which is still more elevated by the spinous orbital ridges. Operculum with a longitudinal convex keel, directed upwards, whereof radiate numerous striae. Occiput and neck elevated into a crest. Superior and inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. All the fins present. Dorsal situated above 4 or 5 rings; its base ele-

vated; its middle about above the anus; caudal small. Eggs numerous, isolated in cutaneous cells on the tail, enclosed in a complete brood-pouch beginning behind anus and formed by lateral cutaneous folds containing more or less developed osseous plates.

Distribution: Two species known from Red Sea, Ceylon, Andamans, New Guinea, Australia, Torres Straits, Philippines, Japan.

In sea, in deeper water near shore.

Key to the indo-australian species of Halicampus.

a. 17—18 trunk rings; snout with a median series of 2—3 spines in its basal half . . . . . *H. koilomatodon* p. 103.

b. 14 trunk rings; snout with a single spine before the eyes . . . . . *H. elegans* p. 104.

1. Halicampus koilomatodon (Blkr.) [Fig. 43, p. 102].

Halicampus conspicillatus Kaup, Cat. Lophobr. Fish, 1856, p. 22 (nec *Syngnathus conspicillatus* Jenyns 1842 [1]).

Syngnathus koilomatodon Bleeker, Act. Soc. Sc. Indo-Neerl. V. 1858—1859, Vijfde Bijdr. Ichth. fauna Japan, p. 10.

Halicampus Grayi Duméril, Hist. nat. Poissons II. 1870, p. 536.

Halicampus koilomatodon Duméril, l. c. p. 537.

Syngnathus grayi Günther, Cat. Brit. Mus. VIII. 1870, p. 169.

Syngnathus Grayii Macleay, Descr. Cat. Austr. Fishes II. 1881, p. 225 (separ. edit.).

Syngnathus trachypoma Günther, Rep. Zool. Coll. Voy. "Alert" 1884, p. 30.

Halicampus koilomatodon Jordan & Snyder, Proc. U. S. Nat. Mus. Wash. XXIV. 1901, p. 10.

Corythroichthys trachypoma Jordan & Seale, Bull. Bur. of Fisheries Wash. XXV. (1905) 1906, p. 214 (name only).

Halicampus Grayi Duncker, Fauna Südwest Australiens II. 1909, Pisces, p. 246.

Trachyrhamphus caba Seale, Philipp. Journ. of Sci. IV. 1909, p. 503.

Halicampus koilomatodon Duncker, Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 111.

D. 19—22; A. 3—5; P. 16—19; C. 10; Rings 17—18+33—36; subdorsal rings 2—3+1—3.

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1) Duncker prefers the specific name *koilomatodon* Bleeker 1859 and not *Halicampus conspicillatus* Kp. 1856 on the following grounds: "Kaup zitiert (l. c.) als Synonyme "*Syngnathus conspicillatus* Jenyns" und einen von ihm selbst im Mus. Brit. angewandten Ms.-Namen "*Halicampus Grayi*." Da er jedoch in seine Beschreibung von *Halicampus conspicillatus* auch Jenyns' Diagnose von *Corythoichthys conspicillatus* mit einbezieht, betrachte ich Bleeker's Bezeichnung *Syngnathus koilomatodon* als erste eindeutige der vorliegenden Art." We follow the opinion of Duncker.

Head $8^1/_2$—9 times in length; 3 times in trunk; tail about twice longer than trunk. Shields transversely striated, their edges prominent and serrated, the inferior edges ending in a short spine; intermedial shields oval, smooth. Snout about equal to postorbital part of head, its posterior half with 2—3 median dorsal spines and a pair of short lateral spines; the concave interorbital space with prominent lines and a median spiny crest; similar crests on occiput and neck. Arborescent cutaneous appendages — more developed in the male — on each ring on its dorsal surface and one on each scutal edge; similar appendages above and below eye and before branchial opening. Opercular keel with a basal spinous prominence, ventrally with 5—12 radial ridges. Before base of pectorals a comb-like crest. Brown, with whitish marblings. Operculum with or without white stripes. Length 152 mm. [A specimen from Japan of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: New Guinea. — Ceylon, Andamans, Philippines, Japan !, Thursday Island, Prince of Wales Island, North West Australia.

2. **Halicampus elegans** (Steind.)

Doryichthys elegans Steindachner, Abhand. Senck. naturf. Gesellsch. XXV. 1901, p. 459.

D. 18; Rings 14+32; subdorsal rings 1+4 (2+3?).

Head short, about 9 times in length, more than $2^1/_2$ times in trunk. Tail more than twice longer than trunk. Superior edges of shields extremely finely dentated, posteriorly ending in a small spine and anteriorly knotted. Snout about $2^1/_2$ times in length of head, mesially with a rather strong spine before the eyes. Eye about 4 times in length of head; orbital ring prominent; interorbital space deeply concave. Occiput and nape with a median keel. Operculum vaulted with a curved keel, feebly ascending hind- and upwards and with numerous prominent lines. Numerous cutaneous simple filaments on head and body; on the trunk on each shield a filament near the edges. Dorsal situated above 5 rings. Light yellow, on each ring 2—3 dark brown annular crossbands, in the middle of their height more or less completely united. Length of the single specimen known 51 mm. [After STEINDACHNER's description and figure].

Habitat: Ternate.

20. Haliichthys Gray.

(Gray, Proc. Zool. Soc. London, 1859, p. 38). *Phyllopteryx* Günther, Cat. Brit. Mus. VIII. 1870, p. 196 (p. p.).

Elongate, trunk as broad as deep, hexagonal or scarcely heptagonal as the abdominal crista is only feebly developed. Tail tetragonal, prehensile, the caudal wanting, much longer than trunk. Shields smooth, their edges with a prominent spine in the middle, except the lower surface of the end of the tail. No intermedial shields; a praenuchal and a nuchal shield present. Head compressed, with a broad crest on occiput and neck, provided with some strong spines and a pair of lateral ones. Eyes large, prominent, a pair of spines above and below them. Snout quadrilateral, longer than remaining part of head; a pair of lateral spines and two ventral cutaneous filaments in middle of snout. Operculum vaulted, with a convex keel, ascending hindwards and upwards and furnished in its basal half with a strong curved spine. Three strong spines before base of pectorals. Long, more or less arborescent cutaneous appendages at base of numerous spines on the edges of trunk and tail, also on occiput and orbit. Superior and inferior cristae of trunk and tail discontinuous; median cristae of trunk and inferior cristae of tail continuous. Dorsal situated on 5 to 6 rings, its base is elevated and its middle somewhat before anus. Anal small; pectorals broad. Eggs numerous, rather small, isolated in

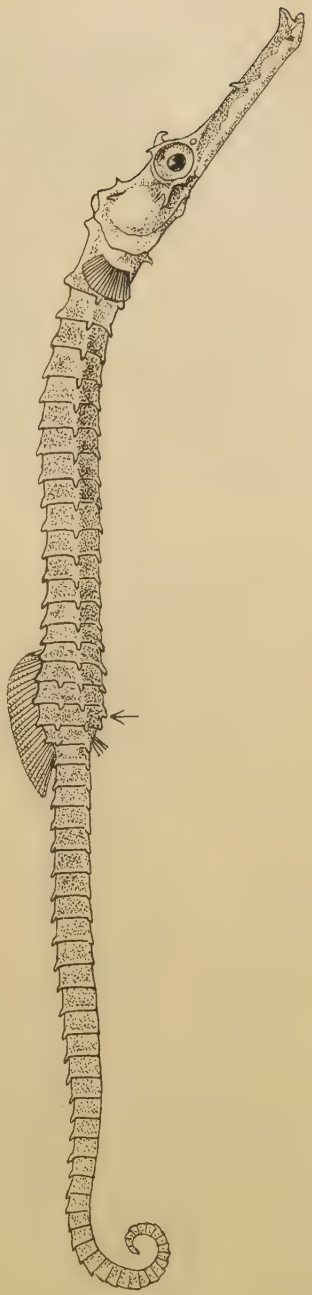

Fig. 44. *Haliichthys taeniophorus* Gray. × 1½. After the specimen from New Guinea, which lacks the cutaneous appendages.

cutaneous cells on tail and enclosed in a complete brood-pouch, formed by a pair of lateral cutaneous folds, beginning behind anus and coalescing in the median line.

Distribution: That of the single species known.

1. Haliichthys taeniophorus Gray [Fig. 44, p. 105].

Haliichthys taeniophorus Gray, Proc. Zool. Soc. London, 1859, p. 38.
Haliichthys taeniophora Duméril, Hist. nat. Poissons II, 1870, p. 531.
Phyllopteryx taeniophorus Günther, Cat. Brit. Mus. VIII. 1870, p. 197.
Phyllopteryx taeniophorus Macleay, Descr. Cat. Austr. Fishes II. 1881, p. 239 (separ. edit.).
Phyllopteryx taeniophorus Max Weber, in: Semon, Zool. Forschungsreisen V. 1895, Fische, p. 275 (Jenaische Denkschr. VIII, p. 115).
Haliichthys taeniophorus Duncker, in: Fauna Südwest Australiens II. 1909, Pisces, p. 236. — Mitt. a. d. naturh. Mus. Hamburg XXXII. 1915, p. 112.

D. 24—26; A. 4; P. 20—21; Rings 19+44—45; subdorsal rings 3—4+2.

Head about 5 times in length, more than $1\frac{1}{2}$ times in trunk. Eye more than 6 times in head. Snout nearly equal to twice the length of postorbital part of head. Brown, with irregular dark bands across the back, abdomen whitish, cutaneous appendages black. Length 300 mm.

Habitat: South New Guinea!. — Prince of Wales Island (Torres Straits); North and West Australia.

In sea.

21. Hippocampus Rafinesque.

(Rafinesque, Caratteri di alcuni Nuovi Generi di Animale della Sicilia, 1810, p. 18).

Trunk strongly compressed, more or less elevated, the belly gibbous, composed of ten to twelve rings, tapering abruptely to a long quadrangular prehensile, finless tail. Longitudinal axis of head forming a right angle with axis of trunk. Occiput compressed, praenuchal shield surmounted by a coronet. Bony shields of bodyrings each with six tubercles or spines, those of tail with four. Sides of head with prominences or spines. Operculum with a convex keel, bent upwards to branchial opening. Cutaneous appendages generally absent. Dorsal moderate, on an elevated base, situated on trunk and tail, opposite to vent. Anal minute, usually present. Pectorals short and broad. Ventrals absent. Broodorgan a permanent egg pouch at the base of the tail, permanently closed by median coales-

cence of the lateral cutaneous folds and provided with a cranial opening near the vent, which can be closed by a circular muscle.

Littoral fishes of small size, represented by numerous species in all tropical and temperate seas. They swim slowly in a vertical position, head uppermost, by a vibrating movement

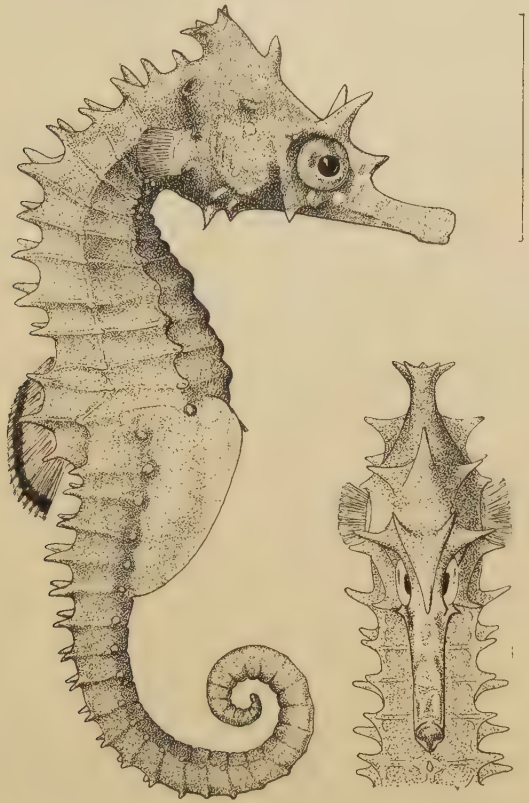

Fig. 45. *Hippocampus spinosissimus* M. Web. × 3.
With front view of head.

of the dorsal fin and attach themselves by the prehensile tail to seaweed or other floating substances, and may be carried by currents to great distances.

Key to the indo-australian species of Hippocampus.

I. D. 27—31. 12 bodyrings . . . . . *H. abdominalis* p. 108.
II. D. 17—21. 11 bodyrings.

1. D. 16—19. Tailrings 33—37.
   a. Tubercles on cristae developed into long, slender spines. Occipital keel behind coronet with two distinct spines.
      α. Snout equal to postorbital part of head. *H. spinosissimus* p. 109.
      β. Snout about one eye-diameter longer than postorbital part of head . . . . . *H. histrix* p. 109.
   b. Tubercles on cristae not developed into long slender spines. Occipital keel behind coronet rough, but without distinct spines. . . . . *H. kuda* p. 110.
2. D. 19—21. Tailrings 38—42 . . . . . *H. trimaculatus* p. 112.

III. D. 13—14. 10 bodyrings. Coronet high . . . . . *H. coronatus* p. 113.

1. Hippocampus abdominalis Less.

Hippocampus abdominalis Lesson in: Férussac, Bull. Sc. Nat. XI. 1827, p. 127.
Hippocampus abdominalis Bleeker, Over eenige visschen van van Diemensland, Verh. Kon. Akad. Amsterdam II. 1855, p. 28.
Hippocampus abdominalis Kaup, Cat. Lophobranch. Fish, 1856, p. 17.
Hippocampus abdominalis Günther, Cat. Brit. Mus. VIII. 1870, p. 119.
Hippocampus abdominalis Duméril, Hist. nat. Poissons II. 1870, p. 524.
Hippocampus abdominalis Macleay, Descr. Cat. Austral. Fish. II. 1881, p. 240 (separ. edit.).
Hippocampus abdominalis Duncker, in: Fauna Südwest Australiens II. 1909, p. 247.
Hippocampus abdominalis Mc Culloch, Zool. Results "Endeavour" Commonwealth Australia, Fisheries I. 1911, p. 29.
Hippocampus graciliformis Mc Culloch, ibid. p. 29.
Hippocampus abdominalis Mc Culloch, Biol. Results "Endeavour", Commonwealth Australia, Fisheries II. part 3, 1914, p. 94 and IV. part 4, 1916, p. 181.
Hippocampus abdominalis Waite & Hale, Rec. South Austr. Mus. I. N°. 4, 1921, p. 319.

D. 27—31; A. 4; P. 15—18; Rings 12+46—49.

Head 1.5 in trunk. Snout straight, cylindrical, equal to postorbital part of head. Eye 7.3—8.3. Coronet low, without distinct tubercles, forming a longitudinal crest. Supra-orbital tubercles large, granular, as well as the tubercle in front of the coronet, surmounted by a filament (absent in the specimen examined, probably lost). Operculum with distinct radiating ridges; occipital keel behind coronet without spines. With exception of those on the head the tubercles are very feebly developed. Cristae rugose. Height of the ridge, which carries the dorsal, equal to half diameter of eye. Dorsal on 10th—12th body-ring and on first to third tailring. Colour of alcohol specimen yellowish brown. Tail with black bands. Black spots on head and body. Length 250 mm. [A specimen of BLEEKER's collection in the Zoological Museum of Amsterdam seen by us].

Habitat: Java (DUMÉRIL). — Coasts of Australia, Tasmania, Lord Howe Island, New Zealand.

Note. DUMÉRIL says that there is a specimen of this species in the Paris Museum, collected by FONTANIER, from Java. As this australian species has never been found again in the indo-australian Archipelago, we doubt the correctness of the locality, where FONTANIER is said to have found his specimen.

2. **Hippocampus spinosissimus** M. Web. [Fig. 45, p. 107].

Hippocampus (*erinaceus* Gthr.?) Max Weber, in: Semon, Zool. Forschungsreisen V. 1895, p. 275 (Jenaische Denkschr. VIII. p. 115).
Hippocampus spinosissimus Max Weber, Siboga-Expeditie, Fische, 1913, p. 120.

D. 17; A. 4; P. 15; Rings 11+34.

Head 1.5 in trunk and 5.8 in total. Trunk somewhat more than twice in tail. Snout straight, equal to postorbital part of head. Eye 5. Coronet elevated, with 5 spines. Supraorbital tubercle vertical, long, pointed. Opercles with distinct radiating ridges. Occipital keel behind coronet with two distinct spines. All the tubercles are developed into long, slender, acute spines. Those on first, fourth, seventh and eleventh bodyring and on fourth, seventh and eleventh tailring still longer than the others. Shields smooth. No filaments. Dorsal on two last bodyrings and first or first and second tailring. Height of the ridge, which carries the dorsal, somewhat less than diameter of eye, and about equal to height of dorsal. Colour of alcohol specimens yellowish brown, with indistinct cross bands on snout. Dorsal with or without a submarginal dark band. Length 75 mm.

Habitat: Strait Sapeh! — Thursday Island!.

3. **Hippocampus histrix** Kp.

Hippocampus histrix Kaup, Cat. Lophobr. Fish, 1856, p. 17.
Hippocampus hystrix Günther, Cat. Brit. Mus. VIII. 1870, p. 206.
Hippocampus hystrix Duméril, Hist. nat. Poissons II. 1870, p. 514.
Hippocampus hystrix Day, Fishes of India 4°, 1878—1888, p. 683.
Hippocampus hystrix Günther, Fische der Südsee III. 1910, p. 436.

D. 17—19; A. 4; P. 17—18; Rings 11+33—34.

Head 1.2—1.3 in trunk. Trunk 1.6—1.9 in tail. Snout straight, twice in head, about one eyediameter longer than postorbital part of head. Eye 7—7.5. Coronet elevated, with 5 spines.

Supraorbital tubercle vertical, long, pointed. Opercles with or without distinct radiating ridges. Occipital keel behind coronet with two distinct spines. All the tubercles are developed into long, slender acute spines. Those on first, fourth, sixth, eighth and eleventh bodyring and on third, sixth, eighth, tenth, twelfth and fourteenth tailring still longer. Shields smooth. No filaments. Dorsal on two last bodyrings and first or first and second tailring. Height of ridge, which carries the dorsal, about half diameter of eye. Height of dorsal less than diameter of eye. Colour of alcohol specimens light brownish yellow, snout with dark transverse lines. Vermiculating fine lines on rest of head, body and trunk. Length 142 mm.

Habitat: Singapore; Java Sea!; Celebes (Makassar!); Aru-Islands!. — Japan, Zanzibar, Réunion, Bourbon, Aden, Red Sea, Andamans, Pacific.

4. **Hippocampus kuda** Blkr.

Hippocampus kuda Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 82.
Hippocampus moluccensis Bleeker, ibid. p. 305.
Hippocampus taeniopterus Bleeker, ibid. p. 306.
Hippocampus kuda Bleeker, Verh. Bat. Gen. XXV. 1853, Bijdr. Troskieuwige visschen, p. 26.
Hippocampus polytaenia Bleeker, Nat. Tijdschr. Ned. Indië, VI. 1854, p. 338.
Hippocampus melanospilos Bleeker, ibid. p. 505.
Hippocampus comes Kaup, Cat. Lophobr. Fish, 1856, p. 10 (p. p.).
? *Hippocampus comes* Bleeker, Act. Soc. Sc. Indo-Neerl. I. 1856, Beschrijv. nieuwe vischsoorten Menado en Makassar, p. 80.
Hippocampus comes Kner, Novara-Exp. Fische, I. 1865—1867, p. 390.
Hippocampus melanospilos Duméril, Hist. nat. Poissons, II. 1870, p. 505.
Hippocampus kuda Duméril, op. cit. p. 506.
Hippocampus comes Duméril, op. cit. p. 512.
Hippocampus rhynchomacer Duméril, op cit. p. 519.
Hippocampus polytaenia Duméril, op. cit. p. 522.
Hippocampus guttulatus Günther, Cat. Brit. Mus. VIII. 1870, p. 202 (p. p.).
? *Hippocampus guttulatus* Day, Fishes of India 4°, 1878—1888, p. 682.
Hippocampus guttulatus Reuvens, Notes Leyden Mus. XVI. 1894, p. 148.
Hippocampus kelloggi Jordan & Snyder, Proc. U. S. Nat. Mus. XXIV. 1901, p. 14.
Hippocampus aterrimus Jordan & Snyder, ibid. p. 14.
Hippocampus kuda Jordan & Snyder, l.c. p. 15.
Hippocampus hilonis Jordan & Evermann, Bull. U. S. Fish Comm. XXII. (1902) 1904, p. 169. — Ibid. XXIII. (1903) 1905, p. 119.
Hippocampus comes Vaillant, Mission Pavie, Indo Chine III. 1904, p. 462.
Hippocampus taeniops Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII. 1904, p. 501.
Hippocampus aterrimus Jordan & Seale, Bull. Bur. Fish. XXVI. (1906) 1907, p. 10.
Hippocampus kuda Jordan & Seale, ibid. p. 10.

Hippocampus kuda Jordan & Richardson, Bull. Bur. Fish. XXVII. (1907) 1908, p. 246.

? *Hippocampus barbouri* Jordan & Richardson, l.c. p. 247.

Hippocampus aterrimus Franz, Abh. d. II. Kl. der Kön. Akad. d. Wissensch. München IV. Suppl. Bd. 1. Abh. 1910, p. 23.

? *Hippocampus kuda* Franz, l. c. p. 23.

Hippocampus kuda Seale, Phil. Journ. Science V. N°. 4. 1910, p. 269.

Hippocampus guttulatus Günther, Fische der Südsee, Journ. Mus. Godeffroy 1910, p. 435 (nec CUVIER).

Hippocampus guttulatus Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard Coll. XXVI. N°. 7, 1911, p. 264 (nec CUVIER).

Hippocampus kelloggi Jordan, Tanaka & Snyder, Journ. Coll. Sci. Univ. Tokyo, XXXIII. Art. 1, 1913, p. 98.

Hippocampus guttulatus Pietschmann, Jahrb. des Nassau. Ver. f. Naturk. Jahrg. 66, 1913, p. 197 (nec CUVIER).

D. 16—18 (generally 17, rarely 15); A. 4; P. 15—17; Rings 11 + 33—37 (generally 36).

Head 1.2—1.6 in trunk. Trunk 1.5—1.7 in tail. Snout straight, 1.9—2.5 in head, equal to or one eyediameter longer than postorbital part of head. Eye 6—8. Coronet generally rather low, obliquely directed backwards, with 5 more or less distinct tubercles. Supraorbital tubercles generally well developed, in front of them at each side a much smaller and often almost inconspicuous one. Opercle with radiating ridges, often indistinct. Occipital keel behind coronet without spines, at most having a rough edge. Tubercles on cristae sometimes well developed, in other cases small and blunt. Those on first, fourth and seventh body ring and first, fifth, eighth, tenth or eleventh, fourteenth and seventeenth tailring sometimes enlarged. The shields are generally smooth, more or less distinctly ridged, sometimes and not only in young specimens covered with small tubercles. Filaments on tubercles very seldom present. Dorsal on two last bodyrings and two first tailrings. The ridge which carries the dorsal fin is low, much lower than in *H. hippocampus* and the fin itself is much lower too. Colour of alcohol specimens very variable. Generally dark brown or black or brown with transverse black bands or elongate dots, with or without numerous white spots. Sometimes yellowish brown individuals occur, in which the tubercles and cristae and especially the crista abdominalis trunci are darker. Still other specimens are brown with large white dots, forming irregular bands. Dorsal generally with a dark subterminal band. Length

about 300 mm. [Specimens of *H. kuda* and *H. melanospilos* of BLEEKER's collection in the Zoological Museum of Amsterdam, seen by us].

Nom. indig. Ikan kuda (Malay) (kuda = horse); Gadjah menong (Simalur).

Habitat: Singapore; Pulu Weh!; Nias!; Pulu Nako!; Simalur!; Sumatra (Priaman, Siboga, Padang, Telok Betong!); Bintang; Banka; Java (Batavia! Tjilatjap); Borneo (Balikpapan!, Sandakan); Celebes (Makassar, Amurang, Menado!); Flores!; Sumba; Timor; Samau!; Ambon!; Banda!; Buru!; Ceram!; Gisser!; Obi; Batjan; Ternate; Halmahera; Misol; Kei-Islands!; Aru-Islands; Schouten Islands (Biak!); New Guinea (Humboldt-bay!, Wilhelmshafen, British South New Guinea). — Tropical coasts of Indic and Pacific as far east as Hawaiian Islands, north to Japan.

In Sea. Littoral.

Note. Dr. G. DUNCKER, who made a thorough study of the genus *Hippocampus*, the results of which have not yet been published, had the great kindness to give us information about the validity of the above species. We agree with him, that GÜNTHER and most later authors were wrong in uniting *H. kuda* with *H. guttulatus* Cuv. from the Atlantic. Lastnamed species has more dorsal rays (D. 18—22, generally 19) and more caudal rings (33—40, generally 38).

5. Hippocampus trimaculatus Leach.

Hippocampus trimaculatus Leach, Zool. Miscellany, 1814, p. 104.
Hippocampus mannulus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1370.
Hippocampus kampylotrachelos Bleeker, Nat. Tijdschr. Ned. Indië VII. 1854, p. 107.
Hippocampus mannulus Kaup, Cat. Lophobr. Fish. 1856, p. 14.
Hippocampus manadensis Bleeker, Beschrijv. nieuwe vischsoorten van Manado en Makassar, Act. Soc. Sc. Indo-Neerl. I. 1856, p. 79.
Hippocampus mannulus Duméril, Hist. nat. Poissons, II. 1870, p. 515.
Hippocampus manadensis Duméril, l. c. p. 523.
Hippocampus kampylotrachelos Duméril. l. c. p. 524.
Hippocampus trimaculatus Günther, Cat. Brit. Mus. VIII. 1870, p. 204.
Hippocampus trimaculatus Day, Fishes of India 4°, 1878—1888, p. 682 (p.p.).

D. 19—21; A. 4; P. 17; Rings 11 + 38—42.

Head 1.3—1.6 in trunk. Trunk 1.8—2 in tail. Snout slender, more or less conspicuously curved upwards, 1.6—1.9 in head, about one to two eyediameters longer than postorbital part

of head. Eye 6—7. Coronet low, much directed backwards, with 5 blunt tubercles. Supraorbital tubercles long, pointed, somewhat directed backwards. Opercles with distinct radiating ridges. Occipital keel behind coronet with two distinct spines. Tubercles on cristae well developed, often conical with rounded granulated top. Those on first, fourth, seventh and eleventh bodyring and on fifth or sixth, tenth, fourteenth, seventeenth and twentieth or twenty first tailring longer than the others. Shields smooth or finely ridged. No filaments. Dorsal on two last bodyrings and first two tailrings. The ridge, which carries the dorsal less high than diameter of eye. Height of dorsal equal to height of third tailring or somewhat less. Colour of alcohol specimens uniform light reddish brown, somewhat lighter on the ventral side. Crista abdominalis trunci sometimes dark brown. Length 137 mm. [Typical specimens seen by us in the British Museum].

Habitat: Singapore; Sumatra (Atchin!, Priaman); Nias!; Celebes (Menado). — Zanzibar, Andamans, Tenasserim, Pinang, China sea.

6. **Hippocampus coronatus** Schl.

Hippocampus coronatus Schlegel, Fauna Japonica, Poissons, 1847, p. 274.
Hippocampus coronatus Kaup, Cat. Lophobr. Fish, 1856, p. 16.
Hippocampus coronatus Karoli, Termeszetrajzi füzetek V. 1882, p. 40.
Hippocampus coronatus Jordan & Snyder, Proc. U. S. Nat. Mus. XXIV. 1901, p. 18.

D. 13—14; P. 14. Rings 10 + 38—40.

Head 1.5—1.6 in trunk. Trunk 1.4—2 in tail. Snout about as long as postorbital part of head. Eye about 7. Coronet very high, pedunculate, varying in form, its tip usually with six lobes or spines. Spines of head and body prominent, the coronet usually with a long filament, other spines occasionaly prominent. First, fourth and tenth bodyrings prominent and usually the fourth, sixth, tenth, fourteenth and sixteenth of the tail. Spines at base of dorsal especially long and prominent. Dorsal short, inserted on two last bodyrings and first tailring. Colour various, usually light brown with dark dots and mattings, sometimes with pale dots and streaks, sometimes with dark brown streaks, the ground colour sometimes almost black; usually light or dark streaks on opercle. Dorsal generally with a blackish band and pale edge, sometimes streaked

like the body. Length 115 mm. (After SCHLEGEL, JORDAN & SNYDER, not seen by us).

Habitat: Borneo (Sarawak). — Japan.

Note. KAROLI (l. s. c.) records this species from Borneo (Sarawak). We doubt the correctness of this statement, as the species has never been found outside the coasts of Japan.

Order SYNENTOGNATHI Gill.

Airbladder without an open duct. Scales present, cycloid. Lateral line present, running low down. Parietals, when present, very small, separated by the supraoccipital. Orbitosphenoid absent. Mesocoracoid arch absent. Opercular bones normally developed. Lower jaw with a sesamoid articulare. Fins without spines. Pectorals inserted very high up. Pectoral arch suspended from the skull. Ventrals abdominal, 6-rayed, not attached to cleithra. Dorsal fin placed far back, totally or partly opposite to anal. Anus posterior. Anterior vertebrae not modified. Mouth small or large, bordered by intermaxillaries and maxillaries. Lower pharyngeals completely united into one plate. Branchiostegals 9—15.

Key to the suborders of Synentognathi.

1. Mouth large, the jaws usually produced. Scales small.
   Third upper pharyngeals separate, fourth usually present. *Scombresocoidea* p. 115.
2. Mouth small, only the lower jaw sometimes produced.
   Scales large or moderate. Third upper pharyngeals
   united, fourth absent . . . . . *Exocoetoidea* p. 134.

I. Suborder **Scombresocoidea.**

Scales small. Mouth large, the jaws usually produced and narrowed forwards, forming a slender beak. Maxillaries firmly united to intermaxillaries. Rami of the lower jaw united through the interlocking of a series of inner processes, which form a more or less roughened ridge between them. Teeth very small, in a series in the jaws or in bands, accompanied by a single series of large teeth. Third upper pharyngeals moderately enlarged, separate; fourth usually present; lower pharyngeal triangular or long and narrow. Pharyngeal teeth usually villiform or granular, some of the teeth of the principal plates often compressed, tricuspid. Parasphenoid without apophysis.

1. Fam. Belonidae.

Very elongate, slender, cylindrical or compressed. Mouth very large. Jaws produced and narrowed forwards, forming a slender beak. Maxillaries more or less concealed below the large praeorbital. Both jaws with bands of small teeth and with a single series of distant canines. Teeth on vomer and tongue present or absent. Pectorals inserted rather high, of moderate length. Dorsal far back, beginning above or behind anal, both fins rather long without detached rays forming finlets. Caudal forked, emarginate, truncate or rounded. Scales cycloid, small or very small, present on praeoperculum, but sometimes absent on operculum. Lateral line running low down, more or less elevated and sometimes forming a keel on the caudal peduncle. Gillopenings wide, gillmembranes not united with isthmus. Third upper pharyngeals moderately enlarged, separate. Second and fourth pair present or absent.

Distribution: All temperate and tropical seas. Some species entering fresh water.

Key to the indo-australian genera of Belonidae.

I. Gillrakers present. In indo-australian species caudal peduncle strongly depressed, keeled . . . . . *Belone* p. 116.

II. Gillrakers absent or vestigial. Caudal peduncle compressed or slightly depressed.

A. Two or three pairs of dentigerous upper pharyngeals. Operculum scaly, or if not so, the tail is forked. Origin of dorsal more or less behind that of anal.

1. Body scarcely or moderately compressed, the height less than twice the breadth of the body. Intermaxillaries not swollen at the base. . . . . *Tylosurus* p. 119.

2. Body strongly compressed. The height twice the breadth of the body. Intermaxillaries swollen at the base. . . . . *Athlennes* p. 130.

B. Only one pair of dentigerous upper pharyngeals. Caudal subtruncate or slightly rounded. Operculum not scaly. Origin of dorsal opposite to that of anal. *Xenentodon* p. 132.

1. Belone Cuvier.

(Cuvier, Règne animal II. 1817, p. 185).

Very elongate, compressed or cylindrical, caudal peduncle sometimes even depressed. Intermaxillaries and mandibles

prolonged, forming a beak. Both jaws with a band of conical teeth and a series of moderate pointed widely-set teeth. Those of the mandibles much smaller than those of maxillarics, which are canines. Teeth on vomer present or absent. Dorsal and anal almost opposite to each other; all the dorsal and anal rays connected by a membrane. Caudal forked. Scales rather small. Lateral line running low down, not forming a keel on the caudal peduncle, which has sometimes a keel above the

Fig. 46. *Belone (Eurycaulus) persimilis* Gthr. × 1/2.
Side- and upper view of end of tail to show that it is flattened.

lateral line. Gillopenings wide. Gillrakers present. Lower pharyngeal triangular, second and third upper pharyngeals dentigerous; fourth usually distinct, dentigerous.

Distribution: East Atlantic, Indic and Tropical Pacific.

This genus can be provisionally devided into the following two subgenera:

A. Vomerine teeth present; tail compressed . . . . . *Belone* s. str. [1]).

B. Vomerine teeth absent; tail depressed . . . . . *Eurycaulus* Ogilby [2]).

Key to the indo-australian species of the subgenus Eurycaulus:

1. Eye $1^1/_2$—$1^2/_3$ in postorbital part of head, equal to interorbital space . . . . . *B. (E.) platyura* p. 118.
2. Eye $1^3/_5$—2 in postorbital part of head, a little more than interorbital space . . . . . *B. (E.) persimilis* p. 118.

1) Not represented in the Archipelago.

2) We use here the name *Eurycaulus*, although it was founded on a misconception. Ogilby (Proc. Royal Soc. Queensland XXI. 1908, p. 91) proposed to subdivide the genus *Tylosurus* into three genera, and one of these genera he called *Eurycaulus*, with the type *B. platyura*; but lastnamed species, having gillrakers, is a *Belone* and not a *Tylosurus*, which fact seems to have escaped Ogilby. The name *Eurycaulus* has presedence before *Platybelone* Fowler (Proc. Acad. Nat. Sc. Philadelphia LXXI. 1919, p. 2).

1. Belone (Eurycaulus) platyura Benn.

Belone platyura Bennett, Proc. Comm. Zool. Soc. London, 1830, p. 168.
Belone platura Rüppell, Neue Wirbelthiere, Fische, 1835—1840, p. 73.
Belone carinata Cuvier & Valenciennes, Hist. Nat. Poissons XVIII. 1846, p. 437.
Belone platura Bleeker, Act. Soc. Sc. Indo-Neerl. II. 1857, Achtste Bijdr. Amboina, p. 85.
Belone platura Günther, Cat. Brit. Mus. VI. 1866, p. 237.
Mastacembelus platurus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 234. — Atl. ichth. VI. 1866—1872, p. 50.
Belone platura Klunzinger, Abh. Zool. bot. Gesellsch. Wien XXI. 1871, p. 577.
Belone platura Steindachner, Denkschr. Akad. Wien LXX. 1900, p. 512.
Belone platura Günther, Fische d. Südsee, Heft VIII. 1909, p. 349.

D. 2.13—14; A. 2.15—19; P. 1.11; V. 1.5; L.l. about 150.

Depressed, pentagonal in crosssection, the height twice in the breadth of the body. Height 18—19, about 22 in length with caudal. Head $2^3/_4$, 3 in length with caudal. Eye $1^1/_2$—$1^2/_3$ in postorbital part of head, equal to interorbital space and 4 times in snout. Head flat above, striated, with a broad, very shallow, scaly median groove; supraorbital region striated. Operculum scaly. Maxillary entirely hidden by praeorbital. Canines weak, short, vertical or subvertical. Height of mandible below eye 4 times in eye. Tongue smooth. Pectorals conspicuously longer than postorbital part of head. Ventrals almost twice in length of pectorals. Base of ventrals midway between base of caudal and eye or a little nearer to base of caudal [according to KLUNZINGER midway between hindmargin of operculum and base of caudal]. Origin of dorsal before that of anal, separated by about 90 scales from occiput. The middle and hinder dorsal and anal rays subequal in length, shorter than the anterior ones. Caudal peduncle very strongly depressed, with a sharp lateral keel above the lateral line. Caudal forked. Darkgreen above, silvery below. Fins more or less yellowish at their base. Length 500 mm. [After BLEEKER, KLUNZINGER and GÜNTHER, not seen by us].

Habitat: Singapore; Ambon. — Red Sea, Mauritius, Pelew Islands, Guam, Fiji Islands, Funafuti, Samoa Islands, Sandwich Islands.

2. Belone (Eurycaulus) persimilis Gthr. [Fig. 46, p. 117].

Belone platyura Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 122. (nec BENNETT).
Belone persimilis Günther, Fische der Südsee, Heft VIII. 1909, p. 349.

D. 2.13; A. 2.17; P. 1.11; V. 1.5; L. l. about 180.

Depressed, pentagonal in crosssection, the height 1.2 in the breadth of the body. Height 25, 27 in length with caudal. Head 2.8; 3.1 in length with caudal. Eye 1.6—2 in postorbital part of head, a little more than interorbital space and 7.4 in snout. Head flat above, with a broad shallow scaly median groove. Supraorbital region striated. Operculum scaly. Maxillary entirely hidden by praeorbital. Canines weak, short and straight. Height of mandible below eye $^1/_6$ of greatest diameter of eye. Tongue smooth. Pectorals a little longer than postorbital part of head, ventrals about 1.5 in pectorals. Base of ventrals somewhat nearer to hindmargin of operculum than to base of caudal. Origin of dorsal above third divided ray of anal, separated by about 120 scales from occiput and by 10—11 scales from lateral line. Middle and posterior dorsal and anal rays subequal in length, much shorter than the anterior ones. Caudal peduncle very strongly depressed, with a sharp lateral keel above the lateral line, its height more than twice in its breadth. Caudal forked. Bluish-black above, silvery below, fins yellowish. Length 500 mm.

Habitat: Flores! — Yap, Northwest Coast of Australia, Sandwich Islands, Tonga Islands, Hawaian Islands.

2. **Tylosurus** Cocco.

(Cocco, Lett. in Giorn. Sc. Lett. Sicil. XLII. 1833, p. 18).

Very elongate, body cylindrical or compressed. Intermaxillaries and mandibles prolonged, forming a beak. Both jaws

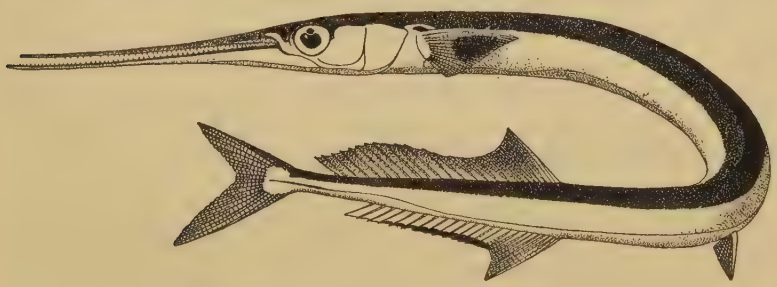

Fig. 47. *Tylosurus melanotus* (Blkr.) × $^1/_3$.

with a band of small teeth and a series of more or less developed canines. No teeth on vomer. Origin of dorsal somewhat or even considerably behind that of anal, all the dorsal

and anal rays connected by a membrane. Caudal fin forked, emarginate, truncate or rounded. Scales small or very small. Lateral line running low down, sometimes forming an elevated keel on the caudal peduncle. Gillopenings wide. Gillrakers absent. Lower pharyngeal elongate, narrow, the dentigerous plate scarcely expanded posteriorly; second and third upper pharyngeals dentigerous; fourth usually distinct, dentigerous.

Distribution: West Atlantic, Mediterranean, Indic and Pacific.

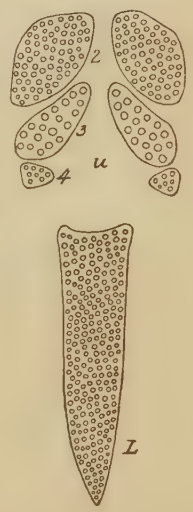

Fig. 48. *L* lower, *u 2*, *3*, *4* upper pharyngeals of *Tylosurus punctulatus*(Gthr.)magnified.

Key to the indo-australian species of Tylosurus.

A. Caudal truncate or rounded. Lateral line not forming a keel on caudal peduncle.

1. Anal 2.13—15; D. 2.10—13. Body cylindrical or only slightly compressed.
   - *a.* L. l. about 170. Caudal with a median black blotch . . . . . *T. strongylurus* p. 121.
   - *b.* L. l. about 125. Caudal without black blotch . *T. macrolepis* p. 122.
2. Anal 2.17—2.23. D. 2.14—18.
   - *a.* Strongly compressed. Origin of ventrals midway between base of caudal and hindmargin of praeoperculum. A. 2.17—19 . . . . . *T. kreffti* p. 123.
   - *b.* Subcylindrical or compressed. Origin of ventrals midway between front- or hindborder of eye and base of caudal. A. 2.20—23.
     - *α.* Origin of dorsal above 7th divided ray of anal. Head 2.8—3.2. . . . . *T. leiurus* p. 124.
     - *β.* Origin of dorsal above 2nd divided ray of dorsal. Head 2.5—2.7 . . . . . *T. incisus* p. 125.

B. Caudal forked. Lateral line forming a keel on caudal peduncle.

1. Canines of upper jaw curved forwards. D. 2.20—22. A. 2.18—20 . . . . . *T. annulatus* p. 126.
2. Canines of upper jaw vertical.
   - *a.* D. 2.23—24. A. 2.20—21. P. 1.11—12 . . . . . *T. melanotus* p. 127.
   - *b.* D. 2.19—21; A. 2.18—19. P. 1.13.
     - *α.* Tongue covered with tubercular asperities. Eye twice in postorbital part of head. . . . *T. crocodilus* p. 128.
     - *β.* Tongue smooth. Eye 2.6—2.8 in postorbital part of head . . . . . *T. punctulatus* p. 129.

1. Tylosurus strongylurus (v. Hass.).

Belone strongylura van Hasselt, Alg. Konst- en Letterbode, Deel I, 1823, p. 130.
Belone caudimacula Cuvier, Règne animal, ed. 2*a* II. 1829, p. 285.
Belone caudimacula Cuvier & Valenciennes, Hist. nat. Poissons XVIII. 1846, p. 452.
Belone caudimacula Cantor, Journ. Asiat. Soc. of Bengal, XVIII. 1850, p. 1228.
Belone caudimacula Bleeker, Verh. Bat. Genootsch. XXIV. 1852, Snoekachtige Visschen, p. 12.
Mastacembelus caudimacula Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 176, p. 294.
Mastacembelus strongylurus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 220.
Belone caudimaculata Günther, Cat. Brit. Mus. VI. 1866, p. 245.
Belone strongylurus Günther, ibid. p. 246.
Mastacembelus strongylurus Bleeker, Atl. ichth. VI. 1866—1872, p. 45.
Belone strongylura Day, Fishes of India 4°, 1878—1888, p. 512.

D. 1.10—2.13; A. 2.13—15; P. 1.9—1.10; V. 1.5; L. l. circa 170.

Slightly compressed, the height being only a little more than the breadth of the body. Tail somewhat more compressed. Height 14—15, 16—17 in length with caudal. Head 2.5—2.7, 2.9—3.1 in length with caudal. Eye 2.6—4 in postorbital part of head, 7—8.3 in snout and about equal to or a little less than interorbital space. Height of mandible below pupil much less than greatest diameter of eye. Upper surface of head flat with a well developed but rather shallow median groove. Supraorbital region with some striae. Maxillary only half hidden by praeorbital. Operculum scaly. Canines rather small, slightly directed backwards. Tongue smooth. Pectorals a little less than, equal to or even a little longer than postorbital part of head. Base of ventrals about midway between eye and base of caudal. The middle and hinder dorsal and anal rays subequal in length and much shorter than the rays in front. Origin of dorsal above 2nd divided ray of anal. Lateral line without distinct keel on caudal peduncle. Caudal rounded. Colour of alcohol specimens brownish, with a lateral silvery band, especially distinct on the posterior half of the body, where it is bordered superiorly by a dark stripe. A bluish black spot at the base of the caudal fin. According to BLEEKER a variety occurs with black spots on head, back and sides. Length 450 mm.

Nom. indig.: Tendrah, Djulong-djulong (Malay Batavia), Katjangan, Lontjong (Javan.), Tuda laut (Bagan Api Api).

Habitat: Singapore; Sumatra (Palembang, Banju Asin, Taluk!, Bagan Api api!, Siboga, Tiku); Nias; Java-sea!; Java (Batavia!, Samarang, Surabaya, Pasuruan); Bintang; Riouw; Banka; Borneo (Pamangkat, Sinkawang, Sungiduri, Pontianak,

Sintang!, Sampit, Banjermassin, Brunai, Sandakan); Madura; Celebes (Makassar!, Lagusi); Ambon; New Guinea (Mimika river). — Thursday Island, North Australia, Philippines, Formosa, Tonkin, Cochin-China, Siam, Burma, British India and Ceylon.

In sea and estuaries.

Note. GÜNTHER separated (loc. supra cit.) some specimens from Ambon and Australia from this species under the name of *B. caudimaculata,* on account of their larger eye, longer head and somewhat longer pectoral fins. Among the numerous specimens from the Indo-australian Archipelago, examined by us, we find only one in which the eye goes less than 3 times in the postorbital part of the head, what would be in accordance with GÜNTHER's *B. caudimaculata*. But in this specimen the head and the pectoral fins are not longer than in the other ones. The length of the pectoral fin seems to be rather variable, being sometimes shorter, sometimes even longer than the postorbital part of the head, without being accompanied by other constant differences. We see therefore no reason to follow GÜNTHER and have included *B. caudimaculata* Günther in the synonymy of *T. strongylurus*.

2. Tylosurus macrolepis (Blkr.).

? *Belone Urvillii* Cuvier & Valenciennes, Hist. nat. Poissons XVIII. 1846, p. 444.
Belone macrolepis Bleeker, Nat. Tijdschr. Ned. Indië XII. 1856, p. 225; ibid. XIII. 1857, p. 374.
Mastacembelus macrolepis Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 221; — Atl. ichth. VI. 1866—1872, p. 45.
Belone macrolepis Günther, Cat. Brit. Mus. VI. 1866, p. 246.
Belone macrolepis A. B. Meyer, Anal. Soc. Esp. Hist. Nat. XIV. 1885, p. 38.

D. 2.11; A. 2.14; P. 1.10; V. 1.5; L.l. circa 132.

Cylindrical, the height being about equal to the breadth. Free portion of the tail compressed. Height 10, about 11 in total length. Head 2.3, 2.5 in length with caudal. Eye thrice in postorbital part of head and $1^1/_2$ in interorbital space and 9 times in snout. Upper surface of head flat, with a rather shallow median groove of moderate width; supraorbital region indistinctly striated. Two thirds of maxillary hidden by the praeorbital. Operculum scaly. Canines rather small, slightly directed backwards. Tongue smooth. Pectorals a little more

than postorbital part of head. Ventrals midway between front-margin of eye and the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Origin of dorsal distinctly behind that of anal. Caudal fin rounded. A silvery lateral band, inconspicuous before dorsal. Dorsal and anal with a series of diffuse spots in the middle, forming a longitudinal band. Pectorals with a large dark patch at their base, especially conspicuous at the innerside of the fin. Length of the only specimen described 420 mm. [Type in the British Museum seen by us].

Habitat: Nias!; Celebes (Menado); Sangir Islands.

In sea.

3. Tylosurus kreffti (Gthr.)

Belone krefftii Günther, Cat. Brit. Mus. VI. 1866, p. 250.
Stenocaulus krefftii Ogilby, Proc. Roy. Soc. Queensland XXI. 1908, p. 91.
Tylosurus krefftii Mc Culloch, Check-list of fish of N. S. Wales, Prt. II. 1919, p. 29.

D. 2.14—2.16; A. 2.17—2.19; P. 1.10; V. 1.5; L. l. 170—190.

Strongly compressed, the breadth of the body $1^2/_3$ times in its height. Height 10—15, 11—17 in length with caudal. Head 2.3—2.4, 2.6 in length with caudal. Eye 2.6—3.8 in postorbital part of head, about equal to interorbital space and 7.2—8.5 in snout. Height of mandible below pupil a little more than half of the greatest diameter of eye. Head flat above, with a shallow median groove. Supraorbital region with a few striae. Maxillaries half hidden by praeorbital. Operculum as well as the greater part of upper surface of head, including the median groove, scaly. Canines slender, straight. Length of pectorals much less than postorbital part of head, slightly more than height of body. Origin of ventrals midway between base of caudal and hindmargin of praeoperculum. Middle and hindermost anal and dorsal rays subequal, much shorter than anterior rays. First dorsal ray above second divided ray of anal. Lateral line without keel on caudal peduncle. Caudal truncate. Colour in alcohol brownish above, yellowish and slightly silvery below, with an indistinct lateral silvery band in the postanal part of the body. Fins dusky. Length 650 mm.

Habitat: New Guinea (Lorentz-river!, Mimika river). — Queensland.

In rivers.

4. Tylosurus leiurus (Blkr.)

Belone leiurus Bleeker, Nat. Tijdschr. Ned. Indië I 1850, p. 94; Verhand. Bat. Genootsch. XXIV. 1852, Snoekachtige Visschen, p. 13.
Mastacembelus anastomella Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 224 (nec C.V.).
Belone leiurus Kner, Fische Novara Exp. 1865—1867, p. 321.
Belone liurus Günther, Cat. Brit. Mus. VI. 1866, p. 250.
Mastacembelus leiurus Bleeker, Atl. ichth. VI. 1866—1872, p. 46.
Belone liura Day, Fishes of India 4°, 1878—1888, p. 511.
Tylosurus leiurus Jordan & Richardson, Bull. Bureau Fish. Washington XXVII. 1908, p. 243.
Strongylura leiura Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXI. 1919, p. 5.

D. 2.16—18 or 1.17; A. 2.21—23; P. 1.10—11; V. 1.5; L. l. 185—200.

Compressed, the breadth of the body going 1.3—1.5 in its height. Caudal peduncle rather variable, sometimes as high as broad, but generally higher than broad. Height 17—26, 18—29 in length with caudal. Head 2.8—3.2, 3—3.4 in length with caudal. Eye 2.5—3.3 in postorbital part of head, 1.1—1.3 in interorbital space and 8 to more than 9 in snout. Upper surface of head flat, with a broad but shallow scaly median groove, which widens anteriorly and through which runs a low, rounded, longitudinal ridge, which disappears anteriorly. Parietals coarsely striated, frontals with some striae, which disappear anteriorly, the supraorbital region being almost smooth. Upper surface of beak with fine striae. Height of mandible below pupil equal to or a little more than diameter of eye. Two thirds of maxillary hidden by praeorbital. Operculum scaly. Canines slender, somewhat curved backwards. Tongue smooth. Pectorals a little longer than or equal to postorbital part of head. Base of ventrals midway between base of caudal and hindborder of eye or somewhat nearer to firstnamed. The middle and hinder dorsal rays subequal in length and much shorter than the anterior ones. Origin of dorsal far behind that of anal, situated above the 7th divided ray of lastnamed fin and separated by 11 or 12 scales from lateral line. Caudal fin subtruncate. Colour in alcohol brownish, with a silvery lateral band, bordered above by a dark line, which is more clearly visible in formol specimens. Pectorals with a black subterminal blotch. Dorsal and — less so — anal with a blackish border. Ventrals hyaline. Caudal dusky. Length 580 mm. [Many specimens of BLEEKER's collection seen by us].

Nom. indig.: Djulong-djulong (Malay Batavia), Kadjang or Langsar (Malay Bantam), Toda palpia (Riouw).

Habitat: Pulu Weh!; Singapore; Sumatra (Benkulen, Padang, Ulakan, Priaman); Nias!; Riouw; Biliton; Java (Batavia!, Krawang!, Bantam, Semarang!, Prigi); Bali; Flores!; Ambon!; Batjan; Aru Islands. — Philippines, Formosa, British India, Ceylon.

5. Tylosurus incisus (C. V.)

Belone incisa Cuvier & Valenciennes, Hist. nat. Poissons XVIII. 1846, p. 451.
Belone leiuroides Bleeker, Nat. Tijdschr. Ned. Indië I. 1851, p. 479; Verhand. Bat. Genootsch. XXIV. Snoekachtige Visschen, 1852, p. 25.
? *Belone brachyrhynchos* Bleeker, Nat. Tijdschr. Ned. Indië VI. 1854, p. 61.
Mastacembelus leiuroides Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 233.
Belone liuroides Günther, Cat. Brit. Mus. VI. 1866, p. 243.
? *Mastacembelus brachyrhynchus* Bleeker, Ned. Tijdschr. Dierk. III, 1866, p. 232. — Atl. Ichth. VI. 1866—1872, p. 49.
Mastacembelus leiuroides Bleeker, Atl. ichth. VI. 1866—1872, p. 50.
? *Belone (Mastacembelus) liuroides* Steindachner, Sitzb. Math. naturw. CI. Akad. Wien LX. I. 1870, p. 570.
? *Tylosurus leiuroides* Fowler, Proc. Acad. nat. Sc. Philad. (2) LVII. 1905, p. 493.
Belone liuroides Günther, Südsee-Fische, Heft VIII. 1909, p. 352.
Belone incisa Max Weber, Siboga-Exp. Fische, 1913, p. 123.
Strongylura leiuroides Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXI. 1919, p. 5.

D. 2.17—18; A. 2.20; P. 1.10—11; V. 1.5; L. l. ± 180—190.

Subcylindrical, the height being equal to or a little more than the breadth of the body. Caudal peduncle as high as broad or somewhat broader than high. Height 15—22, 17—25 in length with caudal. Head 2.5—2.7, 2.7—2.9 in length with caudal. Eye 2—2.5 in postorbital part of head, 1.2 or somewhat less in interorbital space and 6—8 times in snout. Upper surface of head flat, with a rather shallow scaly median groove, which does not widen anteriorly. Supraorbital region, frontals and parietals densely striated. The upper surface of the beak is also provided with deep longitudinal furrows. Height of mandible below pupil scarcely equal to half diameter of eye. Maxillary only just visible below praeorbital, when the mouth is closed. Operculum scaly. Canines well developed, slender, straight. Tongue smooth. Pectorals somewhat longer than postorbital part of head. Base of ventrals midway between base of caudal and middle or frontborder of eye. Length of ventrals about $^3/_4$ of that of pectorals. The middle and hinder dorsal and anal rays subequal in length and much shorter than the

anterior ones. Origin of dorsal above second divided ray of anal, separated by 12 scales from lateral line. Caudal slightly emarginate. Colour in alcohol brownish above, lighter below with an indistinct silvery lateral band. Length 600 mm.

Habitat: Singapore; Java (Batavia!); ?Borneo; Biliton; Celebes (Makassar!); Banda; Halmahera; Timor; Island Biaru!; New Guinea. — Indian Ocean (C.V.), Philippines, Admiralty Islands, Pelew Islands, Ponapé, Ruk, Samoa.

6. Tylosurus annulatus (C. V.)

Belone annulata Cuvier & Valenciennes, Hist. nat. Poissons XVIII. 1846, p. 447.
Belone gigantea Temminck & Schlegel, Fauna Japonica, Poissons II, 1847, p. 245.
Belone melanurus Bleeker, Verhand. Bat. Genootsch. XXII. 1849, Bijdr. Ichth. Madura p. 11.
Belone timucoides Bleeker, Journ. Ind. Arch. III. 1849, p. 67 & 68.
Belone annulata Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1226.
Belone cylindrica Bleeker, Verhand. Bat. Genootsch. XXIV. Snoekacht. Visschen, 1852, p. 13.
Belone gigantea Bleeker, Act. Soc. Sc. Indo-Neerl. III. 1858. Japan p. 21.
Mastacembelus giganteus Bleeker, Ned. Tijdschr. Dierk. I. 1863, p. 236.
Belone cylindrica Kner, Fische Novara Exp. I. 1865—1867, p. 321.
Mastacembelus choram Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 277 (nec Rüppell).
Mastacembelus annulatus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 229.
Belone annulata Günther, Cat. Brit. Mus. VI. 1866—1872, p. 240 (nec syn.).
Mastacembelus annulatus Bleeker, Atl. ichth. VI. 1866—1872, p. 48.
Belone annulata Day, Fishes of India 4°, 1878—1888, p. 510.
Tylosurus giganteus Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1903, p. 529.
Tylosurus giganteus Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 124.
Belone gigantea Günther, Fische der Südsee, Heft VIII. 1909, p. 350.

D. 2.20—22; A. 2.18—2.20; P. 1.12—14; V. 1.5; L.l. circa 350.

Moderately compressed, the breadth of the body going 1.2—1.4 in the height. Free portion of the tail more or less tetrahedral, higher than broad. Height 15—17, 16—20 in length with caudal. Head 3.1—3.3, 3.5—3.7 in length with caudal. Eye 2.1—2.5 in postorbital part of head, 1—1.3 in interorbital space and 5.5 to nearly 7 in snout. Height of mandible below pupil about equal to half (greatest) diameter of eye. Upper surface of head flat with a very broad shallow median groove. A narrow stripe in the middle, widening anteriorly to an oblong patch, is scaly. Sides of groove with deep furrows and well developed ridges. Supraorbital region with very numerous feeble striae, but so feebly developed that the bone is almost

smooth on touch. Maxillary nearly entirely hidden by praeorbital, when the mouth is closed. Operculum not scaly. Canines well developed, subulate, curved forwards. Tongue covered with granular teeth. Pectorals equal to or somewhat longer than postorbital part of head; ventrals a little shorter than pectorals. Base of ventrals about midway between front of eye and base of caudal. Middle dorsal rays the shortest, those of the hinderhalf prolonged, although not so long as the first ray. First anal ray longer than first dorsal ray. Middle and hinder anal rays subequal in length, much shorter than the anterior ones. Origin of dorsal above second undivided, or above first divided ray of anal; 23 or 24 scales between origin of dorsal and lateral line. Lateral line forming a more or less elevated dark brown keel on the caudal peduncle. Caudal forked, less so in young specimens. Colour brownish above, silvery below. Lower lip, which is produced into a flaplike organ in young specimens, dark brown. Fins yellowish, more or less blackish in their distal part; hinderhalf of dorsal almost completely so. Middle caudal rays blackish. Length over 1000 mm.

Nom. indig.: Djulong-djulong (Malay Batavia); Tendrah, Lontjong (Javan.); Kadjang (Malay Bantam); Sakku (Ternate, Ambon), Saku (Menado), Silowang (Batjan).

Habitat: Singapore; Sumatra (Siboga, Benkulen); Nias!; Pulu Weh!; Banka; Riouw; Java (Batavia!, Bantam, Semarang!, Surabaya, Banjuwangi); Bawean Island; Borneo (Sandakan); Cocos Island; Madura; Bali; Lombok!; Solor; Celebes (Makassar!, Bonthain, Badjoa, Menado); Ternate; Batjan; Ambon!; Banda!; Ceram (Kawa!); Waigeu; Aru Islands; New Guinea (British New Guinea, Wilhelmsland!). — From the Seychelles and British India, Japan, Philippines to North Australia and to the Sandwich Islands.

In sea.

7. **Tylosurus melanotus** (Blkr.) [Fig. 47, p. 119].

Belone coromandelica v. Hasselt, Alg. Konst- en Letterbode, I. 1823, p. 130 (nom. nudum).

Belone timucoides v. Hasselt, Bull. de Férussac, II. 1824 Zool. p. 374 (no descr.).

Belone melanotus Bleeker, Nat. Tijdschr. Ned. Ind. I. 1850, p. 94.

Belone melanotus Bleeker, Verh. Bat. Genootsch. XXIV. Snoekacht. Visschen, 1852, p. 14.

Mastacembelus crocodilus Bleeker, Ned. Tijdschr. Dierk. III. 1863, p. 226.

Belone melanotus Günther, Cat. Brit. Mus. VI. 1866, p. 238.

Mastacembelus melanotus Bleeker, Atl. ichth. VI. 1866—1872, p. 47.

Tylosurus coromandelicus Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1903, p. 530.
Tylosurus melanotus Fowler, Journ. Acad. Nat. Sci. Philad. (2) XII. 1904, p. 501.
Belone melanotus Günther, Fische der Südsee, Heft VIII. 1909, p. 352.
Strongylura coromandelica Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXI. 1919, p. 5.

D. 2.23—24; A. 2.20—21; P. 1.11—12; V. 1.5; L.l. ± 335—350.

Compressed, the breadth of the body going 1.3—1.8 in the height of the body. Caudal peduncle almost as broad as high. Height 14—17, 17—18 in length with caudal. Head 3.1—3.3, 3.5—3.6 in length with caudal. Eye about twice or somewhat more in postorbital part of head, slightly less than interorbital space and about 7 times in snout. Height of mandible below pupil one third of horizontal diameter of eye. Upper surface of head flat, striated, with an extremely shallow broad median groove, which is not more than a depression. Maxillary entirely hidden by the praeorbital. Operculum not scaly. Canines short, straight. Tongue covered with numerous patches of very small granular teeth. Pectorals about equal to postorbital part of head; ventrals conspicuously shorter. Base of ventrals about midway between hindmargin of eye and base of caudal. Middle dorsal rays shorter than anterior and posterior ones. Anterior anal rays longer than the others, which are subequal. Origin of dorsal above second simple ray of anal; 20—24 scales between origin of dorsal and lateral line. Lateral line forming a more or less elevated dark keel on caudal peduncle. Caudal forked. Dark brown above, silvery below, the two colours sharply defined. Dorsal blackish. Anal with a dark margin. Pectorals blackish towards their end. Length 600 mm.

Nom. indig.: Djulong-djulong (Malay Batavia), Tjakalang (Moluccos).

Habitat: Singapore; Sumatra (Padang); Java (Batavia); Celebes (Makassar!, North Celebes); Moluccos!; Island Salibabu!; Sumbawa!; Ternate. — North Australia, New Britain, New Caledonia, Formosa, Japan.

In sea.

8. Tylosurus crocodilus (Lesueur).

Esox belone Forskål, Descr. Animal. 1775, p. 67 (nec Linné).
Belone crocodilus Lesueur, Journ. Ac. Nat. Sc. Philad. II. 1821, p. 129.
Belone choram Rüppell, Neue Wirbelthiere, Fische 1835, p. 72.
Belone crocodilus Cuvier & Valenciennes, Hist. nat. Poiss. XVIII. 1846, p. 440.
Belone choram Günther, Cat. Brit. Mus. VI. 1866, p. 239.
Belone choram Klunzinger, Abhandl. zool. bot. Gesellsch. Wien XXI. 1871, p. 578.

Belone choram Day, Fishes of India 4°, 1878—1888, p. 510 (not figure).
Tylosurus crocodilus Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII. 1904, p. 501, pl. IX, upper fig.
Tylosurus choram Seale, Occas. Pap. B. P. B. Mus. IV. 1906, p. 12.
Belone choram Günther, Fische der Südsee, Heft VIII. 1909, p. 351.
Strongylura crocodila Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXI. 1919, p. 5.

D. 22—23; A. 19—21; P. 14; V. 6; L. l.?

Subcylindrical, the breadth of the body going $1\,^1/_5$ in its length. Height 15 in total length. Head 3, its upper surface with a broad and very shallow median groove; superciliary region striated. Eye twice in postorbital part of head, somewhat less than interorbital space and 6 times in snout. Suborbital part of head twice in eye. Maxillary nearly entirely hidden by praeorbital. Operculum not scaly. Canines strong. Tongue covered with tubercular asperities. Pectorals about equal to postorbital part of head, ventrals only a little shorter. Base of ventrals midway between hindmargin of eye and base of caudal. The middle and hinder dorsal rays are very slender and somewhat prolonged. Origin of dorsal behind that of anal. The lateral line forms a very slight keel on the caudal peduncle. Caudal forked. Length over 1000 mm. [After GÜNTHER, DAY and KLUNZINGER, not seen by us].

Habitat: Singapore; Sumatra (Padang); Celebes (Menado); Ambon; Misol. — From East coast of Africa and Red Sea through Indian Ocean to Tonkin, Duke of York Islands, Solomon Islands and Tahiti.

Note. It is astonishing to see that the specific name *choram* has been attributed by almost every author to FORSKÅL, whereas FORSKÅL called the species *Esox belone*. Only at the end of the very short description we read: "Arab. Chaerman vel Choram."

RÜPPELL was the first to use the word *choram* as a specific name, and he correctly called the species "*Belone Choram* Rüppell". But on the same page he introduced the mistake, which has been made over and over again by all later authors — excepting VALENCIENNES — when he said of the species that it is: "bereits von FORSKÅL as *Esox Choram* angedeutet worden".

9. **Tylosurus punctulatus** (Gthr.) [Fig. 48, p. 120].

Belone punctulata Günther, Proc. Zool. Soc. London 1871, p. 670.

D. 2.19; A. 2.18—19; P. 1.13; V. 1.5; L. l. circa 225.

Moderately compressed, the breadth of the body going $1^1/_4$ in the height. Caudal peduncle only a little higher than broad. Height almost 12, 13 in length with caudal. Head 2.8, 3.2 in length with caudal. Eye 2.6—2.8 in postorbital part of head, 1.5 in interorbital space and almost 7.3 in snout. Mandible strong, its height below pupil about equal to vertical diameter of eye. Upper surface of head with a deep broad median groove, tapering anteriorly and prolonged into a narrow median groove on the beak. Superciliary region with numerous fine striae. Maxillary entirely hidden by praeorbital. Operculum not scaly. Canines moderately developed, subulate, straight. Tongue smooth. Pectorals somewhat longer than postorbital part of head. Ventrals as long as pectorals. Base of ventrals midway between base of caudal and centre of eye. Middle and hinder dorsal and anal rays shorter than anterior ones, which are prolonged. First anal rays much longer than those of dorsal. Origin of dorsal above second simple ray of anal; 18 scales between origin of dorsal and lateral line. On the caudal peduncle the lateral line forms a distinct keel, which is not coloured black. Caudal forked, the lobes pointed. Colour when fresh: "belly white or light bluish grey, back dark, with green reflection. Sides with orange spots" (Dr. RUTTEN). Fins dusky. Length 575 mm.

Habitat: Borneo (Balikpapan!); Celebes (Menado).

3. **Athlennes** Jordan & Fordice.

(JORDAN & FORDICE, Proc. U. S. Nat. Mus. 1886, p. 342).

Very elongate. Body extremely compressed, almost ribbon-shaped. Intermaxillaries and mandibles prolonged, forming a slender beak; the intermaxillaries slightly constricted towards

Fig. 49. *Athlennes hians* (C. V.) × $^1/_2$.

their base where they are strengthened by a conical swelling of the bone, with the point directed forwards. Both jaws with a

band of conical, pointed teeth, intermixed with larger ones, which form slender canines. No teeth on vomer. Origin of anal somewhat in advance of that of dorsal, all the dorsal and anal rays connected by a membrane. Caudal forked. Scales very small, adherent. Lateral line running low down, without distinct keel on caudal peduncle. Gillopenings wide. Gillrakers absent. Lower pharyngeal narrow, elongate. Second third and fourth pair of upper pharyngeals dentigerous.

Distribution: that of the only species known.

1. **Athlennes hians** (C. V.) [Fig. 49, p. 130].

Belone crocodila Bleeker, Nat. en Geneesk. Arch. Ned. Indië II (3) 1845, p. 512 (nec Lesueur).
Belone hians Cuvier & Valenciennes, Hist. Nat. Poissons XVIII. 1846, p. 432.
Belone melanostigma Cuvier & Valenciennes, ibid. p. 450.
Belone gracilis Schlegel, Fauna Japonica, Poissons II, 1847, p. 246 (nec Lowe).
Belone schismatorhynchus Bleeker, Nat. Tijdschr. Ned. Indië, I. 1850, p. 95. — Verh. Bat. Genootsch. XXIV. 1852, Snoekacht. Visschen, p. 15.
Belone gracilis Bleeker, Verh. Bat. Genootsch. XXVI. 1854—1857, Nieuwe nalez. Japan, p. 116 (nec Lowe).
Belone schismatorhynchus Kner, Novara Exp. I. Fische, 1865—1867, p. 322.
Mastacembelus gracilis Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 230. (nec Lowe).
Belone schismatorhynchus Günther, Cat. Brit. Mus. VI. 1866, p. 239.
Mastacembelus schismatorhynchus Bleeker, Atl. ichth. VI. 1866—1872, p. 49.
Belone melanostigma Klunzinger, Abh. zool. bot. Gesellsch. Wien XXI. 1871, p. 581.
Belone melanostigma Day, Fishes of India 4°, 1878—1888, p. 509.
Belone gracilis Nyström, Bihang till K. Sv. Vet. Akad. Handl, XIII. Afd. IV. N°. 4, 1887, p. 44. (nec Lowe).
Athlennes hians Jordan & Evermann, Fishes of North and Middle America, Part 1, 1896, p. 718.
Tylosurus schismatorhynchus Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1903, p. 528.
Athlennes hians Jenkins, Bull. U. S. Fish Comm. XXII. (1902) 1904, p. 433.
Athlennes hians Jordan & Evermann, ibid. XXIII. (1903) 1905, p. 125.
Tylosurus caeruleofasciatus Stead, New Fish N. S. Wales Dep. Fish. New South Wales N°. 1, 1908, p. 3.
Belone hians Günther, Fische der Südsee, Heft VIII. 1909, p. 353.
Athlennes caeruleofasciatus Ogilby, Mem. Queensl. Mus. V. 1916, p. 130.
Athlennes caeruleofasciatus McCulloch, Check-list of fish of N. S. Wales, Prt. II. 1919, p. 36.

D. 2.21—23; A. 2.23—25; P. 1.13; V. 1.5; L.l. 450—490.

Very strongly compressed, the breadth going 2.4—2.7 in the length of the body. Height 10—16, 12—18 in length with caudal. Head 3—3.5, 3.3—4 in length with caudal. Eye 2.1—2.6 in postorbital part of head, equal to or shorter than inter-

orbital space and 7—8 in snout. Head flat above, with a broad median groove, which is scaly anteriorly and has a median ridge in its posterior part. Supraorbital region striated. Operculum smooth. Mandible very high, its height below pupil only a little less than diameter of eye. Canines short and slender, those of the upper jaw slightly directed backwards. Tongue smooth. Maxillary entirely or almost entirely hidden by praeorbital. Pectorals variable in length, equal to postorbital part of head or much longer. Ventrals 1.2—1.4 in pectorals; their base somewhat nearer to frontborder of eye than to base of caudal. Origin of dorsal above 4th divided ray of anal, separated by 28—32 scales from lateral line. Middle dorsal rays shorter than anterior and posterior ones. Anterior anal rays much longer than the other ones, which are subequal. Lateral line without distinct keel on caudal peduncle, which is compressed, but less so than rest of body. Caudal forked. Back darkbrown with a green reflection, sides and belly silvery, the two colours rather sharply separated. Six to eight more or less conspicuous dark crossbands on the body behind ventrals. Dorsal almost totally blackish, pectorals and ventrals yellowish, the former with black tips. Caudal dusky. Length over 1000 mm.

Nom. indig.: Djulong-djulong (Malay. Batavia), Sakku (Ternate).

Habitat: Pulu Weh!; Java (Batavia, Semarang!); Ternate; Aru Islands!. — Red Sea, Indic, Pacific: to Japan and the Sandwich Islands; Atlantic: West Indies, ranging from North Carolina to Brasil.

Note. We have compared our specimens from the indo-australian Archipelago with an Atlantic specimen from Curaçao and cannot find any difference. This species is rather a variable one, but this variability is independant from the geographical distribution. Specimens from the indo-australian Archipelago for instance show all the differences, which OGILBY (l. c.) supposes to exist between the atlantic, the east pacific and the australian specimens.

4. **Xenentodon** Tate Regan.

(C. TATE REGAN, Ann. Mag. Nat. Hist. (8) VII. 1911, p. 332).

Very elongate. Body cylindrical or subcylindrical. Intermaxillaries and mandibles prolonged, forming a beak. Both

jaws with a band of small teeth and a series of canines. No teeth on vomer. Origin of dorsal opposite to that of anal; all the dorsal and anal rays connected by a membrane. Caudal subtruncate or slightly rounded. Scales small. Lateral line

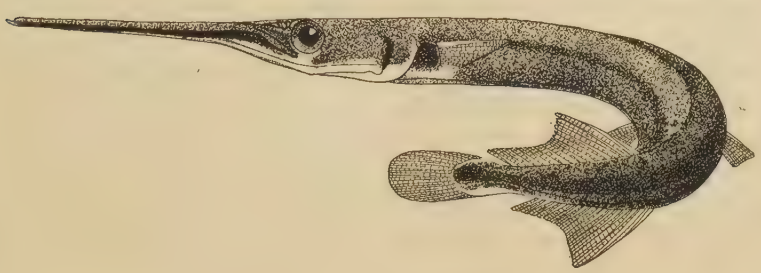

Fig. 50. *Xenentodon canciloides* (Blkr.) × 5/9.

running low down, without keel on caudal peduncle. Gillopenings wide. No gillrakers. Lower pharyngeal small, narrow, pointed or rounded at both ends, only the third pair of upper pharyngeals dentigerous.

Distribution: Fresh water of Sind, India, Ceylon, Burma, Malay Peninsula, Sumatra and Borneo.

1. **Xenentodon canciloides** (Blkr.) [Figs. 50, 51, p. 133].

Belone canciloides Bleeker, Nat. Tijdschr. Ned. Indië, V. 1853, p. 454.
Mastacembelus canciloides Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 223.
Belone canciloides Günther, Cat. Brit. Mus. VI. 1866, p. 253.
Mastacembelus canciloides Bleeker, Atl. ichth. VI. 1866—1872, p. 46.
Belone cancila von Martens, Preuss. Exp. Ost-Asien Zool. Th. I. 1876, p. 400 (nec H. B.).
Belone cancila Vaillant, Notes Leyden Mus. XXIV. 1902, p. 31 (nec H. B.).

Fig. 51. *L* lower, *u* third upper pharyngeals of *Xenentodon canciloides* (Blkr.) magnified.

D. 2.15; A. 2.15; P. 1.8—9; V. 1.5; L.l. 200—220.

Cylindrical, the height being about equal to the breadth of the body. Height 14—18, 15—19 in length with caudal. Head 2.3—2.4, 2.5—2.6 in length with caudal. Eye 2.5—3 in postorbital part of head, equal to or a little less than interorbital space and 8.5 to 9 in snout. Head with a very deep median groove, tapering

anteriorly and continued as a narrow groove on the beak. About two thirds of maxillary hidden by praeorbital. Canines short, subulate, vertical. Tongue smooth. Operculum not scaly. Depth of mandible below pupil less than half diameter of eye. Pectorals conspicuously shorter than postorbital part of head, ventrals 1.5—1.7 in length of pectorals. Base of ventrals about midway between hindmargin of praeoperculum and base of caudal. Origin of dorsal opposite to that of anal [1]), origin of dorsal separated by about 21 scales from lateral line. Middle and hinder dorsal and anal rays much shorter than the anterior ones. Caudal slightly rounded. Colour brownish, more or less silvery below. A brownish lateral band becoming broader and silvery on the tail. Fins hyaline, caudal dusky. Ventrals sometimes tipped with blackish. Length 275 mm.

Nom. indig.: Djulong-djulong (Lampong), Penjolang (Tepu, Borneo).

Habitat: Sumatra (Telokbetong, Pangabuang, Palembang, Benakat, Lahat, Taluk! Djambi!); Borneo (Pontianak, Putus Sibau!, Raun!, Sebruang, Tepu!).

In fresh water.

Species of doubtful occurrence:

1. **Xenentodon cancila** H. B.

MACLEAY (Proc. Linn. Soc. New South Wales, VII. 1883, p. 592) records this species from Port Moresby, New Guinea. As this species has only been found in freshwater of the Asiatic continent and its near relative *X. canciloides* is only known from Sumatra and Borneo, we agree with OGILBY (Mem. Queensland Mus. V. 1916, p. 128) when he says: "I am inclined to doubt the correctness of the identification of this Indo-Burmese fish so far east".

It is not improbable that MACLEAY's specimens belong to *Tylosurus kreffti*, which species lives in the rivers of New Guinea and has a superficial likeness with *X. cancila*.

II. Suborder **Exocoetoïdea.**

Scales large or moderate. Mouth small, the upper jaw not

1) GÜNTHER states l. c.: "The first dorsal ray is opposite to the third or fourth of the anal fin." This is not the case. BLEEKER made this mistake in the first description of the species, but corrected it in his later descriptions.

being prolonged, even in cases where the lower jaw is produced into a beak. Small or minute, sometimes tricuspid, teeth in the jaws and sometimes present on palate and tongue. Second and third upper pharyngeals dentigerous, the third pair strongly enlarged, ankylosed or simply coalescent, forming one somewhat convex ovoid plate; fourth upper pharyngeals absent; lower pharyngeal broad, triangular, with concave upper surface; teeth on principal pharyngeal plates anteriorly villiform, posteriorly incisors with transversely expanded horizontal edge, the two types connected by teeth of intermediate form, many of which are tricuspid. Parasphenoid with an inferior apophysis in front of the upper pharyngeals. Pseudobranchiae hidden, glandular.

Key to the families of Exocoetoidea.

1. Intermaxillaries forming a flat, horizontal, triangular expansion. Lower jaw generally produced into a long beak. Pectorals moderate [1]) . . . . . *Hemirhamphidae* p. 135.
2. Intermaxillaries with a straight transverse anterior border. Lower jaw never produced into a beak. Pectorals long, generally excessively long, forming an organ of flight. . . . . *Exocoetidae* p. 173.

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1. Fam. Hemirhamphidae.

Very elongate, slender, cylindrical or compressed. Maxillaries firmly united to intermaxillaries, which form a flat horizontal, triangular expansion. The symphysis of the lower jaw is always prolonged, sometimes only very little so, but generally much, so that the lower jaw forms a long, slender beak. Teeth rather small, often tricuspid, the part of the lower jaw in front of the intermaxillaries generally without teeth. No teeth on palate or on tongue. Pectorals inserted rather high up, of moderate length, by exception very long. Dorsal long or short, far back, beginning before, above or behind origin of anal. Anal long or short, in the males of viviparous species some of the rays are often modified. Ventrals moderate

1) In the genus *Euleptorhamphus*, not yet found in the indo-australian Archipelago, the pectorals are long, but it is easily recognized as belonging to the *Hemirhamphidae* by its long beak, formed by the lower jaw.

or small. Caudal forked, truncate or rounded. Scales large or moderate, rather deciduous. Lateral line running low down. Gillopenings wide, gillmembranes not united with isthmus. Third upper pharyngeals ankylosed, forming one large plate.

Distribution: All tropical seas, some species entering fresh water or living exclusively in fresh or brackish water.

Key to the indo-australian genera of Hemirhamphidae.

I. Dorsal beginning behind origin of anal and shorter than that fin.
  1. Lower jaw produced into a beak. . . . . *Dermogenys* p. 136.
  2. Lower jaw not produced into a beak . . . . . *Nomorhamphus* p. 141.

II. Dorsal beginning above or before origin of anal, generally longer than that fin.
  1. Lower jaw produced into a beak.
    a. Part of lower jaw beyond extremity of upper jaw provided with teeth. Size small . . . . . *Hemirhamphodon* p. 142.
    b. No teeth on part of lower jaw beyond extremity of upper jaw.
      α. Caudal forked. No modified anal rays in the male. . . . . *Hemirhamphus* p. 145.
      β. Caudal truncate or rounded. Anal rays more or less modified in males . . . . . *Zenarchopterus* p. 162.
  2. Lower jaw not produced into a beak . . . . . *Arrhamphus* p. 171.

1. Dermogenys van Hasselt.

(van Hasselt, Algem. Konst- en Letterbode I. 1823, p. 131).

Elongate, rather compressed. Mandibles prolonged into a beak, which has no teeth except in the part opposite to the intermaxillaries. This beak is bordered along each side by a fold of the skin, which stands out horizontally but is not

Fig. 52. *Dermogenys orientalis* (M. Web.). × 1¾.

always visible in preserved specimens. Intermaxillaries forming a tapering plate, which is truncate in front and therefore has the shape of a trapezium. Small, pointed teeth in both jaws. Dorsal shorter than anal and beginning behind that fin.

None of the rays thickened, but in males the anterior part of the anal is sometimes enveloped by a swollen fold of the skin, which seems to be an outgrowth of the genital papilla. Pectorals inserted high and rather far backwards behind the branchial opening. Ventrals small. Caudal rounded. Scales moderate, rather deciduous. Lateral line running low down, indistinct. Short gillrakers present. Third upper pharyngeals ankylosed. Viviparous.

Distribution: River Hooghly in British India, Siam, Malay Peninsula, Sumatra, Borneo, Java, Celebes, Philippines.

In fresh water.

Key to the indo-australian species of Dermogenys.

I. Base of ventrals a little nearer to head than to caudal.
  A. Length of lower jaw beyond extremity of upper jaw 5.4—6.1 in length. D. 9—10.
    1. A. 15—16. L.l. 45—47 . . . . . *D. orientalis* p. 137.
    2. A. 17—19. L.l. about 50 . . . . . *D. weberi* p. 138.
  B. Length of lower jaw beyond extremity of upper jaw 7.6—8.4 in length. D. 10—12. L.l. 54. . . *D. ebrardti* p. 139.
II. Base of ventrals midway between head and caudal.
  A. 15 . . . . . *D. sumatranus* p. 139.
III. Base of ventrals nearer to caudal than to head. A. 14. *D. pusillus* p. 140.

1. **Dermogenys orientalis** (M. Web.) [Fig. 52, p. 136].

Hemiramphus orientalis Max Weber, Zool. Ergebn. III. 1894, p. 427.
Hemirhamphus orientalis Boulenger, Proc. Zool. Soc. London 1897, p. 429.

D. 9—10; A. 15—16; P. 1.9; V. 1.5; L.l. 45—47.

Somewhat compressed, the breadth of the body going 1.4—1.6 in its height. Height 6.8—7.8, 8.1—9.5 in length with caudal. Head from tip of upper jaw to branchial opening 2.5—2.8 in trunk. Entire head 2.6—2.7, about thrice in length with caudal. Length of lower jaw beyond extremity of upper jaw somewhat more than 6 in length, about 7 in length with caudal. Eye 1.3—2 in postorbital part of head, less than interorbital space. Triangular part of upper jaw truncate in front, longer than broad. Praeorbital rounded, about equal to half diameter of eye. Teeth small, pointed. Origin of dorsal above 5th or 6th anal ray. Dorsal higher than anal, both fins rounded. Pectorals inserted rather far behind branchial opening,

as long as distance between corner of mouth and branchial opening or a little longer. Ventrals about half as long as pectorals, their base a little nearer to head than to caudal. Caudal rounded. Colour yellowish with a fine dark lateral line on the body, accompanied in the posterior part of the body by a faint indication of a silvery lateral band. Length 78 mm.

Habitat: Borneo (river Meridan!); Celebes (Makassar, Maros!, river La-Palupa near Tempe!, Luwu!, river Kalaena, river Toka near Paloppo, stream between Enrekang and Batu lappa).

In rivers.

Note. The specimens from Borneo have a little longer head, when specimens of the same size are compared, but we don't think this sufficient reason to increase the number of species of *Dermogenys*, the characteristics of which are already not sharply defined.

2. **Dermogenys weberi** (Blgr.).

Hemirhamphus weberi Boulenger, Proc. Zool. Soc. 1897, p. 429.
Hemiramphus weberi Max Weber, Bijdragen tot de Dierkunde, Amsterdam 1914, p. 202.

D. 9—10; A. 17—19; P. 1.10; V. 1.5; L.l. about 50.

Compressed, the breadth of the body going about 1.5 in its height. Height 7.4—9, 8.5—10 in length with caudal. Head from tip of upper jaw to branchial opening 2.7—2.8 in trunk. Entire head 2.4—2.6, 2.8—3 in length with caudal. Length of lower jaw beyond extremity of upper jaw 5.4—6.1, 6.2—7.2 in length with caudal. Eye 1.3—1.5 in postorbital part of head, slightly less than interorbital space. Triangular part of upper jaw truncate in front, longer than broad. Praeorbital rounded, somewhat less than or equal to half diameter of eye. Teeth small, pointed. Origin of dorsal above 6th anal ray. Dorsal rounded, somewhat longer than anal, which is almost truncate. Pectorals inserted rather far back behind branchial opening, equal to or somewhat longer than the distance between corner of mouth and branchial opening. Ventrals half as long as pectorals, their base nearer to head than to caudal. Caudal rounded. Colour of preserved specimens blackish above, silvery on the sides and below. Caudal and dorsal somewhat dusky, anal and pectorals hyaline, ventrals with black tips. Length 95 mm.

Nom. indig.: Pangkilan (Buginese).

Habitat: Celebes (Lake Matanna!).

3. Dermogenys ebrardti Popta.

Hemiramphus (Dermatogenys) ebrardtii Popta, Notes Leyden Museum XXXIV. 1912, p. 187.

D. 10—12; A. 15; P. 12; V. 6; L.l. 54.

Compressed, the breadth of the body going 1.8—2 in its height. Height 5—5.5 in length without projecting part of lower jaw, $6^2/_3$—7 in length with caudal. Head from tip of upper jaw to branchial opening $2^1/_5$—$2^5/_8$ in trunk. Entire head 3—3.2 in length with caudal. Length of lower jaw beyond extremity of upper jaw 7.6—8.4 in length, 8.9—9.5 in length with caudal. Eye almost twice in postorbital part of head, 1.2—1.5 in interorbital space. Triangular part of upper jaw longer than broad. Teeth small, pointed. Origin of dorsal above fourth anal ray. Fifth dorsal ray the longest, somewhat less than the second and longest anal ray. Pectorals $6^1/_4$—7 in length with caudal, twice as long as ventrals. Base of ventrals a little nearer to head than to caudal. Caudal rounded. Colour of alcohol specimens yellowish. A dark blotch at base of pectorals. Length about 90 mm. [Type seen by us].

Habitat: South east Celebes (Kabaëna!, Penango!, Rumbia valley!).

Fresh water.

4. Dermogenys sumatranus (Blkr.).

Hemiramphus sumatranus Bleeker, Nat. Tijdschr. Ned. Indië V. 1853, p. 526.
Dermogenys sumatranus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 167. — Atl. ichth. VI. 1866—1872, p. 65.
Hemirhamphus sumatranus Günther, Cat. Brit. Mus. VI. 1866, p. 275.

D. 9—10; A. 15; P. 1.8—9; V. 1.5; L.l. circa 45—50.

Somewhat compressed, the breadth of the body going about 1.5 in its height. Height 8—8.3, 9—10 in length with caudal. Head from tip of upper jaw to branchial opening 2.7—3.3 in trunk. Entire head 2.5—2.7, 2.8—3.1 in length with caudal. Length of lower jaw beyond extremity of upper jaw 5.1—6.6, 7.3—7.5 in length with caudal. Eye 1.5—2 in postorbital part of head, somewhat less than interorbital space. Triangular part of upper jaw truncate in front, longer than broad. Praeorbital rounded, about equal to half diameter of eye. Teeth small, pointed. Origin of dorsal above 5th or 6th anal ray. Dorsal higher than anal, both fins rounded. Pectorals inserted rather

far behind branchial opening, as long as distance between corner of mouth and branchial opening or a little longer. Ventrals about half as long as pectorals, their base midway between base of caudal and branchial opening. Caudal rounded. Colour of preserved specimens yellowish, with a faint indication of a silvery band in the posterior part of the body. Fins hyaline. Length 75 mm.

Nom. indig.: Djulong djulong (Banjermassin).

Habitat: Singapore; Sumatra (Lake Manindjau, Fort de Kock!, Andalas!, Bagan Api Api!); Borneo (Balikpapan!).

In rivers.

5. **Dermogenys pusillus** v. Hass.

Dermogenys pusillus van Hasselt, Algem. Konst- en Letterbode, I. 1823, p. 131.
Hemiramphus fluviatilis Bleeker, Nat. Tijdschr. Ned. Indië I. 1850, p. 95. — Verh. Bat. Gen. XXIV. 1852, Snoekacht. Visschen, p. 16.
Dermogenys pusillus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 165. — Atl. ichth. VI. 1866—1872, p. 64.
Hemirhamphus fluviatilis Günther, Cat. Brit. Mus. VI. 1866, p. 275.
Dermogenys pusillus Bean & Weed, Proc. U. S. Nat. Mus. Wash. XLII. 1912, p. 595.

D. 9—10; A. 14; P. 1.8; V. 1.5; L.l. 45—50.

Somewhat compressed, the breadth of the body going 1.2—1.5 in its height. Height 7—10, 8—11 in length with caudal. Head from tip of upper jaw to branchial opening 2.5—3 in trunk. Entire head 2.3—2.7, 2.8—3.1 in length with caudal. Length of lower jaw beyond extremity of upper jaw 6.6—8 in length, 8—9 in length with caudal. Eye 1.5 to nearly 2 in postorbital part of head, somewhat less than interorbital space. Triangular part of upper jaw truncate in front, longer than broad. Praeorbital rounded, about equal to half diameter of eye. Teeth small, pointed. Origin of dorsal above 6th anal ray. Dorsal higher than anal, both fins rounded. Pectorals inserted rather far behind branchial opening, as long as distance between corner of mouth and branchial opening or a little longer. Ventrals about half as long as pectorals, their base a little nearer to caudal than to branchial opening. Caudal rounded. Colour of preserved specimens yellowish, with a faint indication of a silvery lateral band, a little more distinct below dorsal, and bordered above by a black line. Length 70 mm.

Nom. indig.: Djulong-djulong (Malay. Batavia); Tjaratja (Sumatra).

Habitat: Singapore; Sumatra (Palembang); Java (Batavia, Tandjong Oost, Perdana, Tjampea, Buitenzorg!, Tjipanas!, Tjiandjur, Lelles, Garut, Situ Bagendit!, Grati, Sindanglaja, Megamemdong, Palabuan, Nusa Kembangan, Semarang!); Borneo (Upper Riko river!, Santabug). — Malay Peninsula, Siam.

In rivers.

2. **Nomorhamphus** nov. gen.

Elongate, compressed. Mandible slightly projecting beyond the upper jaw, provided at its tip with a fleshy prolongation, which is curved backwards, at least in preserved specimens. Intermaxillaries forming a triangular plate, which has a band of fine teeth, similar to those of the lower jaw. Origin of dorsal far backwards, behind that of anal and shorter than lastnamed fin. Pectorals inserted high, not as long as head. Ventrals

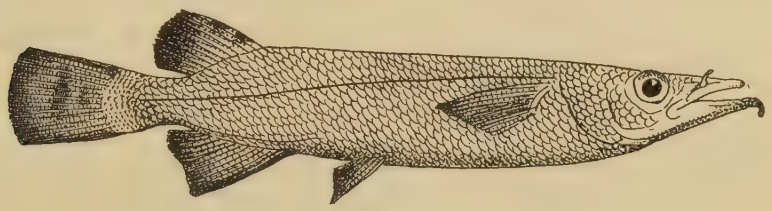

Fig. 53. *Nomorhamphus celebensis* n. sp. × 5/4.

nearer to caudal than to head. Caudal fin rounded. Scales moderate, rather deciduous. Lateral line indistinct, running low down. Gillopenings wide. Gillrakers present, few in number, knoblike and provided with minute spicules, which are also present on the free border of a membrane, situated on the branchial arch (at least on the first), at the innerside of the gillrakers. Viviparous.

Distribution: Fresh water of Celebes.

Key to the species of Nomorhamphus.

1. L.l. 50—55. D. 11—12 . . . . . *N. celebensis* p. 141.
2. L.l. 64. D. 12—13 . . . . . *N. hageni* p. 142.

1. **Nomorhamphus celebensis** n. sp. [Fig. 53, p. 141].

Hemiramphus (Dermatogenys) spec. Max Weber, Bijdragen tot de Dierkunde, Amsterdam, 1914, p. 202.

D. 11—12; A. 15; P. 1.11; V. 1.5; L.l. 50—55.

Rather compressed, the breadth of the body going about 1.75 in its height. Height 5 and 6 in length with caudal. Head 3—3.3, 3.5—4 in length with caudal. Eye 3.5—5.5 in head, 1.75 in flat interorbital space. Triangular part of upper jaw as long as broad. Teeth pointed, somewhat curved backwards, especially those at the symphysis of the upper jaw. Band of teeth in the upper jaw broader than that of lower jaw. Origin of dorsal above 6th anal ray. Dorsal rounded, shorter than anal, which is subtruncate. Pectorals about equal to head without snout, ventrals longer than half length of pectorals, their base midway between caudal and middle or hindborder of eye. Caudal rounded. Colour of preserved specimens yellowish with a fine dark longitudinal line. Pectorals and ventrals tipped with black. Dorsal with a black blotch at the base of its hindborder and some dark patches along the frontborder. Anterior and posterior border of anal blackish as well as upper, lower and hindborder of caudal, which last fin has moreover indications of crossbands. Length 84 mm.

Habitat: Celebes (Lake Posso!, rivulet at Lappa Kanrŭ!).

2. **Nomorhamphus hageni** (Popta).

Hemiramphus hageni Popta, Notes Leyden Museum XXXIV. 1912, p. 190.

D. 12—13; A. 15; L.l. 64; L.tr. 24.

Compressed, the breadth of the body going 2—$2^2/_3$ in its height. Height 4.5—5. Head $3^1/_7$—$3^4/_7$. Eye 5.5—6, 1.8—2 in postorbital part of head and $1^2/_3$ in interorbital space. Triangular part of upper jaw $1^1/_4$ times as long as broad. Teeth small. Origin of dorsal above fourth anal ray. Origin of ventrals midway between hindborder of eye and base of caudal. In all known specimens the fins are broken off at their base, so that nothing can be said of their length or height. Colour of alcohol specimens olive brown above, yellowish below. A black blotch on the shoulder. Length 94 mm. [Types seen by us].

Habitat: South east Celebes (Penango! and Rumbia-valley!). Fresh water.

3. **Hemirhamphodon** Bleeker.

(Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 140).

Elongate, compressed. Mandibles prolonged into a long beak, which is provided with small, pointed teeth. Lower jaw pro-

vided with a lateral horizontal fold of the skin on each side, especially developed in the part opposite to the upper jaw and not always conspicuous in preserved specimens. Intermaxillaries forming a triangular plate, which has a band of teeth, similar to that of the lower jaw. Origin of dorsal backwards, before that of the anal and much longer than lastnamed fin. Pectorals

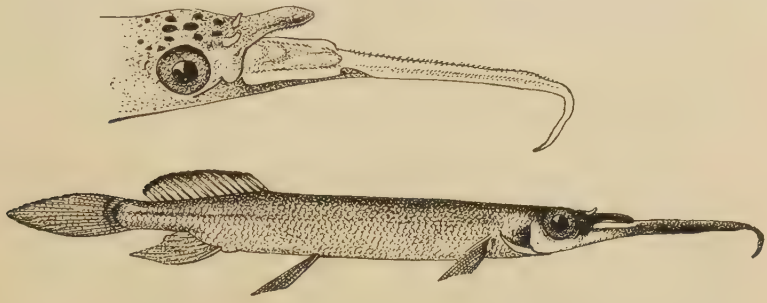

Fig. 54. *Hemirhamphodon pogonognathus* (Blkr.) × 7/10.
Upper figure the head magnified to show the teeth in lower jaw.

not inserted so high as in other genera of the group, shorter than head. Ventrals shorter or longer than pectorals, before or behind origin of dorsal. Caudal rounded. Scales very small. Gillopenings wide. Short gillrakers present. Viviparous.

Distribution: Malay Peninsula, Singapore, Sumatra, Banka, Biliton and Borneo.

In fresh and brackish water.

Key to the species of Hemirhamphodon.

1. D. 21—23. Origin of ventrals behind that of dorsal. *H. phaiosoma* p. 143.
2. D. 15—17. Origin of ventrals before that of dorsal. *H. pogonognathus* p. 144.

1. Hemirhamphodon phaiosoma (Blkr.)

Hemiramphus phaiosoma Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekacht. Visschen p. 26. — Nat. Tijdschr. Ned. Indië III. (1851) 1852, p. 99.
Hemirhamphodon phaiosoma Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 168. — Atl. ichth. VI. 1866—1872, p. 66.
Hemirhamphus phaiosoma Günther, Cat. Brit. Mus. VI. 1866, p. 272.

D. 21—23; A. 9; P. 1.7—8; V. 1.5; L.l. circa 90 [1]).

Compressed, the breadth of the body going 1.5 in its height. Height 8.3, 9.1 in length with caudal. Head from tip of upper

1) Bleeker (l. c.) mentions only about 70.

jaw 2.6 in trunk. Entire head 2.2, 2.6 in length with caudal. Lower jaw beyond extremity of upper jaw 4.1 in length, 4.8 in length with caudal. Eye 1.4 in postorbital part of head, about equal to interorbital space. Triangular part of upper jaw longer than broad. Dorsal beginning far before base of ventrals, thrice as long as anal, rounded. Pectorals about equal to head without snout. Ventrals about equal to postorbital part of head, their base nearer to caudal than to head. Caudal rounded. Colour of preserved specimens brownish. Length 77 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Singapore; Biliton; Banka; Borneo (Palandok, Sadong Matang).

In rivers.

2. **Hemirhamphodon pogonognathus** (Blkr.) [Fig. 54, p. 143].

Hemirhamphus pogonognathus Bleeker, Nat. Tijdschr. Ned. Indië V. 1853, p. 193.
Hemirhamphodon pogonognathus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 169. — Atl. ichth. VI. 1866—1872, p. 66.
Hemirhamphus pogonognathus Günther, Cat. Brit. Mus. VI. 1866, p. 273.
Hemirhamphodon kükenthali Steindachner, Abh. Senckenb. Naturf. Ges. XXV. 1901, p. 450.
Hemirhamphus pogonognathus Volz, Zool. Jahrb. (Syst.) XIX. 1903, p. 394.

D. 15—17; A. 6—7 [1]); P. 1.7—8; V. 1.5; L. l. 94—100.

Compressed, the breadth of the body going 1.5 in its height. Height 10—10.4, 11—12 in length with caudal. Head from tip of upper jaw to branchial opening 2.5—2.8 in trunk. Entire head, excluding the barbellike prolongation on tip of lower jaw, 2.2—2.4 in length, 2.5—2.7 in length with caudal. Lower jaw beyond extremity of upper jaw (excluding the barbellike prolongation at its tip) 4.3—5.1 in length, 5—5.8 in length with caudal. Eye about equal to interorbital space and about 1.2 in postorbital part of head. Triangular part of upper jaw longer than broad. Dorsal beginning behind origin of ventrals but before that of anal. Base of anal about 2.5 in that of dorsal. Pectorals about equal to head without snout. Ventrals somewhat longer than pectorals, the inner ray the longest. Base of ventrals midway or nearly midway between caudal and head. Caudal rounded. Colour of preserved specimens

1) STEINDACHNER l. c. mentions A. 9, but this is probably a misprint, as on the beautiful and exact figure on Plate XVII l. c. only 7 rays are represented.

dark brown above, lighter below. A dark patch on operculum, according to STEINDACHNER green, with a red patch above it. Fins more or less darkish, dorsal with a dark border. Length 189 mm.

Habitat: Sumatra (Palembang, Taluk!, Gunung Sahilan!, brook in Simbolong mountains); Banka; Biliton; Borneo (Sarawak, river Kapuas, river Baram). — Malay Peninsula.

In fresh and brackish water.

4. **Hemirhamphus** Cuvier.

(CUVIER, Règne Animal, tome II. 1817, p. 186).

Very elongate, body cylindrical or compressed. Mandibles prolonged into a long beak, which has no teeth except in the

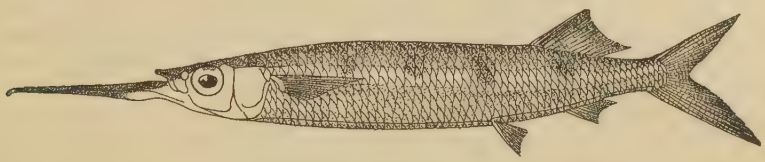

Fig. 55. *Hemiramphus far* Rüpp. × 2/5.

part opposite to the intermaxillaries, and is bordered by 3 more or less conspicuous folds of the skin, one along each edge and a median one, beginning on the chin. Intermaxillaries forming a triangular plate, which has a band of teeth, similar to that of the lower jaw. The teeth are small, often tricuspid. Origin of dorsal far backwards, somewhat before or opposite to anal, which is generally shorter than the well developed dorsal. Pectorals inserted high up, not longer than head. Ventrals differently placed: nearer to head than to caudal, equidistant from both, or nearer to caudal than to head. Caudal fin more or less deeply forked, the lower lobe the longer. Scales large or moderate, rather deciduous. Lateral line running low down. Gillopenings wide. Gillrakers well developed. Third upper pharyngeals ankylosed (see fig. 56 p. 148).

Distribution: Tropical and subtropical seas. Generally near shore, going in schools.

Key to the indo-australian species of Hemirhamphus.

I. Pectorals not as long as head from tip of upper jaw to branchial opening.

A. Triangular part of upper jaw longer than broad. *H. georgii* p. 147.

B. Triangular part of upper jaw broader than long.

1. Base of ventrals midway between frontborder or hindborder of eye and base of caudal.

a. Head from tip of upper jaw to branchial opening 3.2 in trunk. Caudal with a black border . . . . . *H. unifasciatus* p. 149.

b. Head from tip of upper jaw to branchial opening 3.5—3.7 in trunk. Caudal with a black border . . . . . *H. gaimardi* p. 150.

c. Head from tip of upper jaw to branchial opening 3.7—4 in trunk. Tips of caudal black. . . . . *H. melanurus* p. 151.

2. Base of ventrals more backwards, at most midway between head and base of caudal, generally nearer to base of caudal than to head.

a. Anal with 14—16 divided rays. Dorsal and anal opposite to each other or nearly so. Praeorbital as long as eye . . . . . *H. balinensis* p. 152.

b. Anal with 9—13 divided rays. Praeorbital shorter than eye.

α. Cylindrical or nearly so, the breadth of the body equal to or 1.2 in its height. Anal with 11—13 divided rays. Dorsal and anal opposite or nearly so.

a'. Length of lower jaw beyond extremity of upper jaw 6.6—9.8 in length. Origin of ventrals midway between base of caudal and head . . . . . *H. quoyi* p. 154.

b'. Length of lower jaw beyond extremity of upper jaw 4.5—5.2 in length. Origin of ventrals nearer to base of caudal than to base of pectorals. . . *H. dussumieri* p. 155.

β. Compressed, the breadth of the body going 1.4—1.8 in its height. Anal with 9—10 divided rays. Origin of anal opposite to 5th dorsal ray.

a'. Length of base of anal about twice in that of dorsal. Body with 4—9 black blotches. . . . . *H. far* p. 156.

b'. Length of base of anal 1.5—1.7 in that of anal. Body of adults without blotches . . . . . *H. marginatus* p. 157.

II. Pectorals as long as head from tip of upper jaw to branchial opening . . . . . *H. convexus* p. 159.

Doubtful species . . . . . *H. russelli* p. 161. *H. erythrorhynchus* p. 162. *H. lucens* p. 162.

1. Hemirhamphus georgii C. V. [Fig. 56, p. 148].

Hemirhamphus longirostris Bleeker, Nat. & Geneesk. Arch. Ned. Ind. II 1845, p. 512 (nec C.V.).
Hemiramphus georgii Cuvier & Valenciennes, Hist. Nat. Poissons XIX. 1846, p. 37.
Hemiramphus georgii Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1230.
Hemiramphus Georgii Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekacht. Vissch. p. 19.
Hemirhamphus Cantori Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 145.
Hemiramphus georgii Kner, Novara Exp. Fische, 1865—1867, p. 323.
Hemirhamphus georgii Günther, Cat. Brit. Mus. VI. 1866, p. 264.
Hemirhamphus cantoris Günther, l. c.
Hemirhamphus Cantori Bleeker, Atl. ichth. VI. 1866—1872. p. 53.
Hemirhamphus cantori Day, Fishes of India 4°. 1878—1880, p. 514.
Hemiramphus cantoris Jordan & Seale, Bull. Bur. Fish. Washington XXVI. (1906) 1907, p. 8.
Hemirhamphus georgii Günther, Fische der Südsee, Heft VIII. 1909. p. 355.

D. 2.11—2.15; A. 2.12—2.13; P. 1.9—1.10; V. 1.5; L.l. 57—60.

Compressed, the breadth of the body going 1.2—1.6 in its height. Height 12—14.5, 14.4—16.3 in length with caudal. Head from tip of upper jaw to branchial opening 3—3.4 (3.7 in small specimens) in trunk. Entire head 2.15—2.2 (less than twice in small specimens, which have a comparatively much longer lower jaw), 2.3—2.6 in length with caudal. Length of the lower jaw beyond the extremity of the upper jaw 3.2—3.5 in length, 3.5—3.8 in length with caudal, in small specimens the lower jaw is comparatively much longer, f. i. in one of 141 mm. total length 2.5, 2.8 in length with caudal. Eye 1.5—1.7 in postorbital part of head, somewhat less than interorbital space. The triangular part of the upper jaw, formed by the intermaxillaries, is convex and longer than broad at its base. Teeth in upper jaw in a band, tapering posteriorly, those of the lower jaw in a narrow band, tapering anteriorly. Origin of anal below 2nd or 3rd divided ray of dorsal. Origin

of dorsal separated by 38—42 scales from occiput and by 6—8 scales from lateral line. Dorsal and anal with a concave free border, the anterior rays the longest. Pectorals about equal to or somewhat shorter or longer than head without snout. Ventrals somewhat more than half the length of the pectorals, their origin about twice as near to base of caudal as to corner of mouth. Caudal forked, the middle rays longer than the eye. Colour of preserved specimens yellowish or brown, with a silvery band on the sides, broadest below dorsal

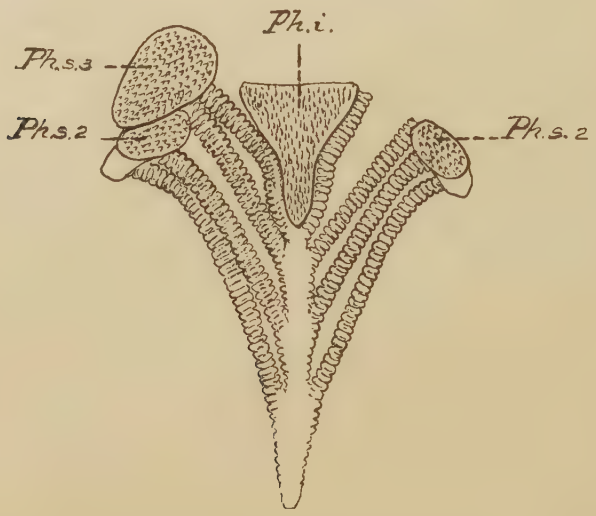

Fig. 56. Visceral arches of *Hemirhamphus georgii* C.V., laid open dorsally in the median line and spread out. The third upper pharyngeals (Ph. s. 3) ankylosed into a dentigerous oval plate which is turned to the right. Ph. s. 2 second upper, Ph. i lower pharyngeals.

and bordered above by a narrower black band. Mandibulary fringes black. Fins hyaline, dorsal and caudal more or less distinctly bordered with black. Length 295 mm.

Nom. indig.: Djulong djulong (Malay Batavia, Bagan Api Api).

Habitat: Pulu Weh!; Singapore; Sumatra (Bagan Api Api!); Java (Batavia!, Semarang!, Pekalongan!, Surabaya); Bali; Java Sea!; Borneo (Sinkawang); New Guinea. — Guam, Philippines, Formosa to China, Strait Settlements, British India, Seychelles, Mauritius.

In sea.

Note. DAY described (Fishes of India 4°, p. 515) under the name of *H. Georgii* a species, which is not identical with the one described by CUVIER & VALENCIENNES. DAY did evidently so after examination of what be believed to be the type of *georgii*. He says: "DUSSUMIER's specimen of *H. Georgii* from Mahé is still preserved at Paris; it has D. 15" etc. At the end of the description of *H. georgii* in the Histoire Naturelle des Poissons we read however: "L'individu que nous venons de décrire est long de dix pouces et demi. Il vient de la rade de Bombay. Nous en avons un second exemplaire de même taille, pêché dans la baie de Mahé, de Coromandel." Evidently the french authors made thus a mistake in labelling this second specimen as *georgii*. DAY gives under the synonymy of his species also *Hemirhamphus marginatus*. This is however still an other species, differing in the number of dorsal and anal rays, in the form of the triangular part of the upper jaw etc.

2. Hemirhamphus unifasciatus Ranz.

Hemirhamphus unifasciatus Ranzani, Nov. Comm. Acad. Sc. Inst. Bonon. V. 1842, p. 326.
Hemirhamphus neglectus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 157.
Hemirhamphus unifasciatus Günther, Cat. Brit. Mus. VI. 1866, p. 262.
Hemirhamphus unifasciatus Bleeker, Atl. ichth. VI. 1866—1872, p. 59.
Hemirhamphus unifasciatus Day, Fishes of India 4°. 1878—1888, p. 514.
Hyporhamphus unifasciatus Jordan & Evermann, Fishes of North and Middle America, Part 1, 1896, p. 720.
Hyporhamphus neglectus Fowler, Journ. Acad. Nat. Sci. Philad. (2) XII. Prt. 4, 1904, p. 501.
Hemiramphus neglectus Jordan & Richardson, Bull. Bur. Fish. Washington XXVII. 1908, p. 243.
Hyporhamphus neglectus Fowler, Proc. Acad. Nat. Sc. Philadelphia LXXI. 1919, p. 6.
Hyporhamphus unifasciatus Fowler, l. c.

D. 2.12—13; A. 2.12—14; P. 1.10—11; V. 1.5; L.l. 50—55.

Compressed, the breadth of the body going 1.2—1.4 in its height. Height about 10, 11—12 in length with caudal. Head from tip of upper jaw to branchial opening 3.2 in trunk. Entire head about 2.7, about 3.2 in length with caudal. Length of lower jaw beyond extremity of upper jaw 5.7—6 in length, 6.8—7.1 in length with caudal. Eye 1.4—1.5 in postorbital part of head and about equal to interorbital space. Triangular part of upper jaw, formed by intermaxillaries, broader than long. Praeorbital somewhat longer than high, shorter than eye.

Teeth conspicuously tricuspid, in bands of 4—5 rows in the jaws, that of the lower jaw widening posteriorly. Origin of anal about opposite to that of dorsal, which is separated by 32 scales from occiput and by 5 scales from lateral line. Dorsal and anal concave, their anterior rays the longer. Base of dorsal not much longer than that of anal. Pectorals about equal to head without snout. Length of ventrals about $^5/_8$ that of pectorals, their rays subequal. Base of ventrals midway between base of caudal and frontborder or middle of eye. Caudal deeply emarginate. Colour of preserved specimens yellowish or brown, with a rather narrow lateral silvery band, bordered above by a black line. Fins hyaline, dorsal and caudal more or less distinctly bordered by blackish. Length 300 mm. [Specimens of BLEEKER's collection seen by us].

Habitat: Sumatra (Padang); Java Sea!; Java (Batavia, Samarang!); Timor!; Amboina. — Philippines, British India, East coast of Africa, Atlantic coasts of Tropical America, Pacific coast of Panama.

3. Hemirhamphus gaimardi C.V.

Hemiramphus Gaimardi Cuvier & Valenciennes, Hist. Nat. Poiss. XIX. 1846, p. 36.
? *Hemiramphus limbatus* Cuvier & Valenciennes, l. c. p. 44.
? *Hemiramphus tridentifer* Cantor, Journ. Asiat. Soc. Bengal, XVIII, 1850, p. 1231.
Hemiramphus Gaimardi Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekacht. Vissch. p. 20. — Ned. Tijdschr. Dierk. III. 1866, p. 158.
Hemirhamphus gaimardi Günther, Cat. Brit. Mus. VI. 1866, p. 263 (partim).
Hemiramphus gaimardi Kner, Novara Exp. Fische, 1865—1867, p. 323.
Hemirhamphus Gaimardi Bleeker, Atl. ichth. VI. 1866—1872, p. 60.
Hemirhamphus limbatus Day, Fishes of India 4°. 1878—1888, p. 516.
Hemirhamphus gaimardi Seale, Philippine Journ. Science V. 1910, p. 267.
? *Hemiramphus limbatus* Fowler, Proc. Ac. N. Sc. Philadelphia LXX. 1918, p. 3.
Hemirhamphus gaimardi Mc Culloch, Check list of fish of N. S. Wales, Prt. II. 1919. p. 31.

D. 2.12—13; A. 2.12—14; P. 1.10—11; V. 1.5; L.l. about 50.

Somewhat compressed, the breadth of the body going 1.2—1.4 in its height. Height 8.2—11, 10—13 in length with caudal. Head from tip of upper jaw to branchial opening 3.5—3.7 in trunk. Entire head 2.5—2.8, 3—3.3 in length with caudal. Length of lower jaw beyond extremity of upper jaw 5.6—6 in length, 6.4—7 in length with caudal. Eye about 1.5 in postorbital part of head and about equal to interorbital space. Triangular part of upper jaw, formed by intermaxillaries, broader than long. Praeorbital somewhat longer than high,

shorter than eye. Teeth conspicuously tricuspid, in bands of 5—6 rows in the jaws, that of the lower jaw widening posteriorly. Origin of anal about opposite to that of dorsal, which is separated by 31—34 scales from occiput and by 5—6 scales from lateral line. Dorsal and anal concave, their anterior rays the longer. Base of dorsal not much longer than that of anal. Pectorals about equal to head without snout or a little longer. Length of ventrals about $^5/_8$ of that of pectorals, their rays subequal. Base of ventrals about midway between frontborder of eye and base of caudal. Caudal deeply emarginate. Colour of preserved specimens yellowish, with a rather narrow lateral silvery band, bordered above by a black line. Fins hyaline, upper and frontborder of dorsal, and upper, lower and posterior border of caudal blackish. Length over 312 mm.

Nom. indig.: Djulong djulong (Malay Batavia).

Habitat: Singapore; Sumatra (Benkulen, Padang, Priaman, Bagan Api Api!); Nias; Riouw; Banka; Java sea!; Java (Batavia!, Semarang!, Surabaya, Panarukan); Madura!; Borneo (Pamangkat, Balikpapan!, Kota Baru!, Sandakan); Celebes (Makassar, Menado); Ternate; Obi; Ambon; New Guinea. — Philippines, Western Pacific?, British India.

In sea and estuaries.

4. **Hemirhamphus melanurus** C.V.

Hemiramphus melanurus Cuvier & Valenciennes, Hist. Nat. Poissons XIX. 1846, p. 42.
Hemirhamphus melanurus Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekacht. Vissch. p. 19. — Ned. Tijdschr. Dierk. III. 1866, p. 156.
Hemirhamphus gaimardi Günther, Cat. Brit. Mus. VI. 1866, p. 263 (partim).
Hemirhamphus melanurus Bleeker, Atl. ichth. VI. 1866—1872, p. 58.

D. 2.13—15; A. 2.14—15; P. 1.10—11; V. 1.5; L.l. 55.

Slightly compressed, the breadth of the body going about 1.2 in its height. Height more than 9 to 11.5, more than 11 to 13.5 in length with caudal. Head from tip of upper jaw to branchial opening 3.7—4 in trunk. Entire head 2.8—3, 3.3—3.4 in length with caudal. Length of lower jaw beyond extremity of upper jaw about 6 in length, almost 7 in length with caudal. Eye – according to age – 1.2—1.5 in postorbital part of head and about equal to interorbital space. Praeorbital somewhat longer than high, shorter than eye. Triangular part of upper jaw, formed by intermaxillaries, nearly twice as broad as long. Teeth small, in bands of 5—7 rows

in each jaw. Origin of anal about opposite to that of dorsal, which is separated by 34—37 scales from occiput and by 6 scales from lateral line. Dorsal and anal concave, the anterior rays the longer. Base of dorsal not much longer than that of anal. Pectorals somewhat longer or shorter than or equal to head without snout. Length of ventrals about $^3/_5$ of that of pectorals, the outer ray the longest. Base of ventrals about midway between frontborder of eye and base of caudal, in young specimens nearer to caudal. Caudal forked. Colour of preserved specimens yellowish, with a silvery lateral band, broadest between origin of anal and dorsal and bordered above by a blackish line. Fins hyaline. Tip of anterior part of dorsal and tips of caudal black. Length 236 mm.

Nom. indig.: Djulong djulong, Rodja rodja (Malay Batavia).

Habitat: Singapore; Sumatra (Atjeh!); Riouw; Banka; Java Sea!; Java (Batavia!, Semarang!); Celebes (Menado!); Salibabu!; Batjan. — Solomon Islands?, Formosa?, Madras?

Note. GÜNTHER (Cat. Brit. Mus. VI. 1866, p. 265) described quite another species from Hongkong as *Hemirhamphus melanurus* C.V. The description in the "Histoire naturelle des Poissons" is too short to state with absolute certainty if BLEEKER's or GÜNTHER's *H. melanurus* is that of C. V. As C.V.'s specimen came from Celebes and as the description of the colour agrees exactly with that of BLEEKER's specimens, we think that BLEEKER's species has to be called *melanurus* C.V. That of GÜNTHER has to be called *Güntheri*, which name was proposed by BLEEKER (Atl. ichth. VI. p. 59). KNER (Novara Exp. I. p. 324) mentions *melanurus* C.V. from Madras, SEALE (Occas. Papers B. P. Bishop Mus. IV. 1906, p. 13) from the Solomon Islands; JORDAN & RICHARDSON (Mem. Carnegie Mus. IV. 1909, p. 176) mention it from Formosa. As they give no description, it is impossible to make out if *melanurus* C.V. (Blkr.) or *güntheri* Blkr. is meant.

5. Hemirhamphus balinensis Blkr.

Hemiramphus balinensis Bleeker, Nat. Tijdschr. Ned. Indië XVII. 1858—1859, p. 170.

Hemirhamphus intermedius Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 154 (nec CANTOR).

Hemirhamphus balinensis Günther, Cat. Brit. Mus. VI. 1866, p. 261.

Hemirhamphus balinensis Bleeker, Atl. ichth. VI. 1866—1872, p. 58.

Hemirhamphus balinensis Waite, Mem. Austr. Mus. III. 1899, p. 195.
Hemiramphus balinensis Max Weber, Siboga-Exped. Fische. 1913, p. 130.

D. 2.13—15; A. 2.14—16; P. 1.9—10; V. 1.5; L.l. 58—60.

Compressed, the breadth of the body going 1.3—1.5 in its height. Height 11—16, 12—18 in length with caudal. Head from tip of upper jaw to branchial opening 3.1—3.5 in trunk. Entire head 2.3—2.6, 2.7—3.1 in length with caudal. Length of lower jaw beyond extremity of upper jaw 3.5—4.5 in length, 4—5 in length with caudal. Eye 1.5—1.8 in postorbital part of head and equal to interorbital space. Praeorbital much longer than high, its length equal to diameter of eye. Triangular part of upper jaw, formed by intermaxillaries, somewhat broader than long. Teeth small, in narrow bands in both jaws. Origin of anal below or slightly behind that of dorsal, which is separated by 39—41 scales from occiput and by 6—7 scales from lateral line. Dorsal and anal concave, the anterior rays the longer. Base of dorsal equal to or a little longer than that of anal. Pectorals conspicuously shorter than head without snout. Ventrals about $^2/_3$ length of pectorals, their first ray the longest. Origin of ventrals midway between head and base of caudal. Caudal forked. Colour of preserved specimens yellowish, darker above, each scale of the back having a dark brown spot. A silvery lateral band, broadest below origin of dorsal, bordered above by a more or less conspicuous blackish blue line. Fins more or less dusky, especially the dorsal and caudal. Length 220 mm.

Habitat: Bali; Sumba!; Flores!; Kajoa!; between Gebe and Fau!; Ceram!; Binongka!; Tiur!. — Funafuti.

In sea.

Note. Very young specimens are characterized by having a row of about 15 partly alternating black points on each side of the back, between the end of the dorsal and the head (see Max Weber l. c.).

Besides these specimens we have 7 specimens from Pulu Babi, West Coast of Sumatra, which are less compressed (breadth 1.1—1.2 in height), have a comparatively somewhat larger eye and have the origin of ventrals conspicuously nearer to base of caudal than to head. The triangular part of the upper jaw is somewhat longer, nearly as long as broad. In every other point they are like *H. balinensis*.

We propose to call them *H. balinensis* var. *occidentalis*.

6. Hemirhamphus quoyi C.V.

Hemiramphus Quoyi Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 35.
Hemirhamphus Quoyi Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 491. — Verh. Bat. Gen. XXIV. 1852, Snoekacht. Vissch. p. 26. — Ned. Tijdschr. Dierk. III. 1866, p. 153.
Hemirhamphus quoyi Günther, Cat. Brit. Mus. VI. 1866, p. 267.
Hemiramphus quoyi Kner, Novara Exp. Fische, 1865—1867, p. 323.
Hemirhamphus quoyi Bleeker, Atl. ichth. VI. 1866—1872, p. 57.
Hemiramphus quoyi Jordan & Seale, Bull. Bur. Fish. Wash. XXVI. 1907, p. 8.
Hyporhamphus quoyi Evermann & Seale, l. c. p. 58.

D. 2.13—15; A. 1.12—13 or 2.12; P. 1.10—11; L.l. 50—55.

Slightly compressed, the breadth of the body going about 1.2 in its height. Height 8—10, 9.3—13 in length with caudal. Head from tip of upper jaw to branchial opening 3.1—3.6 in trunk. Entire head 2.7—3.3, 3.2—3.8 in length with caudal. Length of lower jaw beyond extremity of upper jaw 6.2—9.8 in length, 7.3—11.4 in length with caudal. Eye 1.2—1.9 in postorbital part of head and somewhat less than or equal to interorbital space. Praeorbital somewhat longer than high, its length much less than diameter of eye. The triangular part of the upper jaw, formed by the intermaxillaries, is nearly twice as broad as long. Teeth conspicuously tricuspid, rather strong, in broad bands of 6—7 rows in upper and lower jaw. Origin of anal opposite to first or second divided ray of dorsal. Origin of dorsal separated by 36—38 scales from occiput and by 6 or 7 scales from lateral line. Dorsal and anal concave, the anterior rays the longer. Length of base of anal about 1.3 in that of dorsal. Pectorals somewhat shorter or longer than head without snout. Ventrals about $^3/_5$ of length of pectorals, their first ray the longest. Origin of ventrals midway between base of caudal and head or somewhat nearer to former. Caudal forked. Colour of preserved specimens yellowish, back darker, each scale having a dark brown spot. A silvery lateral band, broadest below origin of dorsal, bordered above by a bluish black one. Fins hyaline, caudal and upper part of dorsal more or less dusky. Ventrals and pectorals often with a black base in young specimens. Length over 300 mm.

Nom. indig.: Djulong djulong (Malay Batavia); Puput (Riouw).

Habitat: Singapore; Sumatra (Benkulen, Padang, Ulakan, Trussan, Siboga); Nias; Riouw; Banka; Java (Batavia, Semarang!, Bantam); Borneo (Bandjermassin, Sinkawang, Matang);

Madura!; Lombok!; Flores!; Rotti!; Celebes (Makassar!, Bonthain, Badjoa); Buton!; Sangi-Islands; Ambon!; Aru-Islands; Halmaheira!; Waigeu!; New Guinea (Doreh, Etna bay!, British New Guinea). — Philippines, Queensland.

7. Hemirhamphus dussumieri C. V.

Hemirhamphus erythrorinchus var. Lesueur, Journ. Acad. Nat. Sc. Philad. II. 1821, p. 138.
Hemiramphus Dussumieri Cuvier & Valenciennes, Hist. Nat. Poissons XIX. 1846, p. 33.
Hemiramphus Reynaldi Cuvier & Valenciennes, l. c. p. 39.
Hemiramphus Dussumierii Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekacht. Vissch. p. 18.
Hemiramphus dussumieri Kner, Novara Exp. Fische I. 1865—1867, p. 322.
Hemirhamphus dussumieri Günther, Cat. Brit. Mus. VI. 1866, p. 266 (nec Syn.).
Hemirhamphus Dussumieri Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 150. — Atl. ichth. VI. 1866—1872, p. 56.
Hemiramphus Dussumieri Klunzinger, Abh. zool. bot. Ges. Wien, XXI. 1871, p. 584.
Hemirhamphus reynaldi Day, Fishes of Brit. India 4°, 1878—1888, p. 515.
Hyporhamphus dussumierii Evermann & Seale, Bull. Bur. Fish. XXVI. 1907, p. 58.
Hemirhamphus dussumieri Günther, Fische der Südsee, Heft VIII. 1909, p. 354.
Hemiramphus dussumieri Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard Coll. XXVI. No. 7, 1911, p. 251.
Hemirhamphus Reynaldi M. Weber, Siboga-Expeditie, Fische 1913, p. 132.

D. 2.12—14; A. 2.11—13; P. 1.10—12; V. 1.5; L.l. 52—56.

Cylindrical, the height being equal to the depth of the body or nearly so. Height more than 9—11, 12—13 in length with caudal. Head from tip of upper jaw to branchial opening about 3.5 in trunk. Entire head 2.5—2.8, 2.9—3.1 in length with caudal. Length of lower jaw beyond extremity of upper jaw 4.5—5.2 in length, 5—5.9 in length with caudal. Eye 1—1.2 in postorbital part of head and about equal to interorbital space. The triangular part of the upper jaw, formed by the intermaxillaries, is broader than long. Teeth rather well developed, in the upper jaw in a band of about 3 rows, in the lower jaw in about 5 rows. The band of the lower jaw tapering a little anteriorly. Origin of anal about opposite to first divided ray of dorsal. Origin of dorsal separated by 34—37 scales from occiput and by 6 or 7 scales from lateral line. Dorsal and anal concave, the anterior rays the longer. Length of base of anal about 1.2 in that of dorsal. Pectorals somewhat shorter than head without snout. Ventrals longer than half of pectorals, their last ray not longer than the penultimate

one. Origin of ventrals a little nearer to base of caudal than to axil of pectorals. Caudal forked. Yellowish, back darker, each scale having a dark brown spot. A narrow silvery stripe along the sides, bordered above by a blackish line. Fins hyaline, dorsal and caudal dusky. Ventrals often with a black base. Length over 300 mm.

Nom. indig.: Djulong-djulong (Malay Batavia), Mauru (Ambon).

Habitat: Singapore; Pulu Weh!; Sumatra (Atjeh!, Telokbetong, Benkulen, Ulakan, Priaman); Nias!; Batu; Banka; Java (Batavia!, Prigi); Java sea!; Cocos-Keeling Islands; Bali; Sumba!; Timor; Bawean; Celebes (Makassar, Badjoa, Kema); Sangi Islands!; Ternate; Obi; Buru; Ambon; Banda. — From the Red Sea and east coast of Africa to the Riu-Kiu Islands and the Society Islands.

In sea.

8. **Hemirhamphus far** (Forsk.) [Fig. 55, p. 145].

Esox far Forskål, Descript. Anim. 1775, p. 67.
Hemiramphus commersonii Cuvier, Règne Animal, 2. éd. vol. 2, p. 286.
Hemiramphus far Rüppell, Neue Wirbelthiere, Fische Roth. Meer. 1835, p. 74.
Hemiramphus Commersonii Cuvier & Valenciennes, Hist. Nat. Poissons XIX. 1846, p. 28.
Hemiramphus Commersonii Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekachtige Visschen, p. 17.
Hemirhamphus far Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 146.
Hemirhamphus commersonii Günther, Cat. Brit. Mus. VI. 1866, p. 271.
Hemirhamphus far Bleeker, Atl. ichth. VI. 1866—1872, p. 54.
Hemiramphus far Klunzinger, Abh. zool. bot. Ges. Wien XXI. 1871, p. 582.
Hemirhamphus far Day, Fishes of India 4°. 1878—1888, p. 516.
Hemiramphus far Jordan & Evermann, Proc. U. S. Nat. Mus. Wash. XXV. 1902, p. 329.
Hemirhamphus far Günther, Fische der Südsee, Heft VIII. 1909, p. 357.
Hemiramphus commersoni Snyder, Proc. U. S. Nat. Mus. Wash. vol. 42, 1912, p. 494.
Hemirhamphus far Mc Culloch, Check-list of fish of N. S. Wales, Prt. II. 1919, p. 31.

D. 2.11—2.12; A. 1.9—1.11; P. 1.11—1.12; V. 1.5; L.l. 50—52.

Compressed, the breadth of the body going 1.4—1.8 in its height. Height 6.6—7.4, 7.7—8.6 in length with caudal. Head from tip of upper jaw to branchial opening 2.9—3.1 in trunk. Entire head 2.3—2.4, 2.7 in length with caudal. Length of lower jaw beyond extremity of upper jaw 4—4.3, about 5 in length with caudal. Eye 1.4—1.6 in postorbital part of head and somewhat less than interorbital space. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader

than long. Teeth stout, in the upper jaw in 2 or 3 series, in the lower jaw in about 4 series, the bands of teeth do not taper conspicuously anteriorly or posteriorly. Origin of anal below about 5th dorsal ray. Origin of dorsal separated by 32—34 scales from occiput and by 6 scales from lateral line. Dorsal and anal concave, the anterior rays the longer. Length of base of dorsal about twice that of anal. Pectorals longer than head without snout. Ventrals half as long as pectorals, their origin twice nearer to base of caudal than to tip of upper jaw. Caudal forked. Colour of preserved specimens yellowish, darker above, with a well defined silvery lateral band, bordered above by a bluish one. On each side dorsally 4—9 aequidistant black blotches. Fins hyaline, dorsal and caudal more or less dusky. Length 500 mm.

Nom. indig.: Djulong djulong (Malay Batavia); Tratjas (Javan. Tjilatjap); Bolobo (Menado); Roja, Mowaru (Batjan).

Habitat: Singapore; Sumatra (Siboga, Padang, Priaman, Benkulen); Banka; Java (Batavia!, Bantam, Semarang, Pasuruan, Tjilatjap); Madura!; Java Sea!; Borneo (Sarawak); Celebes (Makassar, Bulukomba, Badjoa, Sindjai, Menado, Tamani bay!); Halmaheira; Ternate; Batjan; Obi-major; Ambon!; Ceram!; New Guinea (Atjatuning!, British N. Guinea). — From East Africa and the Red Sea through the Indian Ocean and the Pacific to the Riu-Kiu Islands in the North and the Society Islands in the East.

In sea.

9. **Hemirhamphus marginatus** (Forsk.)

Esox marginatus Forskål, Descript. Animal, 1775, p. 67.
? *Hemiramphus brevirostris* Cuvier, Règne Animal 3ième. Ed. Poissons, p. 235.
Hemiramphus Lutkei Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 49.
Hemiramphus Russeli Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekachtige Visschen, p. 17. (nec C.V.)
Hemiramphus fasciatus Bleeker, Nat. Tijdschr. Ned. Indië, V. 1853, p. 89.
Hemiramphus russellii Kner, Novara-Exp. Fische, 1865—1867, p. 323.
Hemirhamphus marginatus Günther, Cat. Brit. Mus. VI. 1866, p. 270.
Hemiramphus fasciatus Günther, l. c. p. 271.
Hemirhamphus marginatus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 148. — Atl. ichth. VI. 1866—1872, p. 54.
Hemirhamphus fasciatus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 152. — Atl. ichth. VI. 1866—1872, p. 57.
Hemiramphus marginatus Klunzinger, Abh. zool. bot. Ges. Wien XXI. 1871, p. 583.
Hemirhamphus brevirostris Steindachner, Abhandl. Senckenb. naturf. Ges. XXV. 1901, p. 450.
Hemiramphus fasciatus Max Weber, Siboga-Expeditie, Fische. 1913, p. 131.

D. 2.11—12; A. 2.9—10; P. 1.10—11; V. 1.5; L.l. 53—56.

Strongly compressed, the breadth of the body being one half of its height. Height 8.1—8.7, 9.5—9.8 in length with caudal. Head from tip of upper jaw to branchial opening 2.8—3.2 in trunk. Entire head 2.2—2.4, 2.7—2.8 in length with caudal. Length of lower jaw beyond extremity of upper jaw 4—4.4, 4.5 to more than 5 in length with caudal. Eye 1.4—1.7 in postorbital part of head and equal to or even a little more than interorbital space. The triangular part of the upper jaw, formed by the intermaxillaries, is broader than long. Teeth stout, in the upper jaw in 2 series, in the lower jaw in about 4 series; the bands of teeth do not taper conspicuously anteriorly or posteriorly. Origin of anal about opposite to 5th dorsal ray. Origin of dorsal separated by 32—37 scales from occiput and by 6 scales from lateral line. Dorsal and anal concave, the anterior rays the longer except in young specimens (see below). Length of base of anal 1.5—1.7 in that of dorsal. Pectorals longer than head without snout. Ventrals about half as long as pectorals, their inner ray produced and longer than the penultimate one. Origin of ventrals twice nearer to base of caudal than to tip of upper jaw. Caudal forked. Colour of preserved specimens brownish, more or less silvery, darker above. A lateral silvery band, bordered above by a more or less distinct narrower blackish band. Pectorals, ventrals and anal hyaline, the last two sometimes tipped with black. Dorsal black in front and along its free border. Caudal bordered with black above, below and posteriorly. (For colours of young specimens see below). Length more than 300 mm.

Nom. indig.: Djulong-djulong (Malay Batavia), Ongwaru (Ternate).

Habitat: Singapore; Pulu Weh!; Java (Batavia!, Bantam, Cheribon!, Semarang!, Pekalongan!, Surabaya!, Panarukan!); Duizend-Islands; Java Sea!; Celebes (Makassar, Lagusi, Menado); Sangir Islands!; Ternate; Batjan; Obi; Ambon; Flores!, Taam!. — Red Sea, British India, Philippines, China, Palm Islands, New Caledonia.

In sea and estuaries.

Note. We have united *H. fasciatus* Blkr. with *H. marginatus* Forsk. BLEEKER described this species after one specimen of 64 mm. One of us described afterwards other specimens

of 55—80 mm. We have now a series of specimens, which show the transgression from typical *H. fasciatus* to *H. marginatus*. In specimens of 35—85 mm. length the body is cross-barred, in two specimens of 133 and 135 mm. and in another of 164 mm. there are still a few traces of these bars. The ventrals are extremely developed in very young stadia. In specimens of 35—50 mm. the ventrals are even longer than the pectorals and reach far on anal. In a specimen of 62 mm. the ventrals, although still reaching on anal, are shorter than the pectorals. One of the principal features of BLEEKER's *H. fasciatus* is the form of the dorsal, which is not concave, the first rays being the shortest, the fin is gaining in height posteriorly. In our specimens from 35—86 mm. this is distinctly the case, the last dorsal rays reaching on caudal. In a specimen of 133 mm. these last dorsal rays are still somewhat longer than the anterior ones, but don't reach the caudal, while in a specimen of 162 mm. the first dorsal rays are longer than the rest. In the young stages (*H. fasciatus*), the fins, especially the ventrals, which are nearly black, are much more densely pigmented than in the adults.

10. Hemirhamphus convexus n.sp.

Hemiramphus spec. juv. Max Weber, Siboga-Expeditie, Fische. 1913, p. 132.

D. 14—15; A. 14; P. 12; V. 6; L.l. ± 50.

Somewhat compressed, the breadth of the body going 1.5 in its height. Height 7.3—7.5, 8.7 in length with caudal. Head from tip of upper jaw to branchial opening 3—3.3 in trunk. Entire head 2.9, 3.4—3.5 in length with caudal. Length of lower jaw beyond extremity of upper jaw 7—8 in length, 8—9 in length with caudal. Eye about $1^1/_2$ in postorbital part of head and about equal to the interorbital space, which is convex. Triangular part of upper jaw, formed by intermaxillaries, very short, about thrice as broad as long. Praeorbital almost quadratic, much shorter than eye. Origin of anal about opposite to 5th ray of dorsal. Origin of dorsal separated by about 32 scales from occiput and by 5—6 scales from lateral line. Dorsal concave, the rays increasing in length posteriorly; free border of anal straight. Pectorals as long as head from tip of upper jaw to branchial opening. Ventrals about half as long as pectorals, the inner ray the longest. Base of ventrals somewhat nearer to base of caudal than to end of pectorals. Caudal

deeply forked. Silvery, back brownish. A faint indication of lateral narrow violet band. Tips of ventrals, pectorals, and posterior part of dorsal and anal black. Length 76 mm.

Habitat: Timor!; between Gebe and Fau!. — Pelagic.

Note. We have three specimens of this species, two of which have already been described by one of us from material of the Siboga Expedition, and one from the anchorage of Kupang, Timor, collected at night by the late Dr. V. D. SANDE. It is possible that they represent only a young stage of an unknown species and that the form of the dorsal f. i. will change afterwards, as is the case in *H. marginatus*; but the fact that we did not find such a form among the very extensive material of *Hemirhamphus* from the indo-australian Archipelago at our disposition, makes this supposition improbable. The great length of the pectoral and the convex interorbital space distinguish it from all species known to us, even from their young stages. Perhaps it is nearest to *Hemirhamphus cuspidatus* C.V. (Hist. Nat. Poissons XIX. 1846, p. 56), only imperfectly known from the description of the french authors. This species has also a long pectoral, short intermaxillaries and — according to the figure — a convex interorbital space and a dorsal, the upperborder of which is not concave. It has however a much shorter lower jaw ($^1/_{13}$ of the total) and other fin formulae: D. 18, A. 12.

Fig. 57. *Hemiramphus* spec. juv. Head of a young specimen with black dermal appendages on the chin.

GILL (Proc. Acad. Nat. Sc. Philadelphia, 1863, p. 273) separated the lastnamed species from *Hemirhamphus* and created the genus *Oxyporhamphus* for it. We think it better for the moment to keep our species under *Hemirhamphus*, although it stands somewhat apart in this genus, as the genus *Oxyporhamphus* is still so imperfectly known. The fish described by SEALE from the Philippines as *Oxyporhamphus brevis* (Philippine Journ. of Science IV. 1909, p. 495) is quite different and belongs to the genus *Arrhamphus* (see p. 171).

A small specimen of 51 mm. length, from the Island Binongka belongs probably also to *H. convexus*. It is however distinguished by two black dermal appendages of 2.5 mm. length, situated on a common base on the chin (Fig. 57 after M. WEBER, Siboga Exp. Fische 1913, p. 133).

11. Hemirhamphus russelli C. V.

Hemirhamphus Russeli Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 32.
Hemiramphus russelli Cantor, Journ. Asiat. Soc. of Bengal XVIII. 1850, p. 1229.
Hemirhamphus Russeli Karoli Janos, Termes zetrajzi füzetek V. 1882, p. 36.

"D. 17; C. $15^{3}/_{4}$; A. 13; V. 6; P. 12; Br. XIII.

"The length of the head from the apex of the intermaxillaries is $^{1}/_{6}$ of the total measured to the point of the lower, longer, caudal lobe. The length of the lower jaw, from the apex to the angle of the mouth, slightly exceeds the length of the head, varying in different individuals from $^{1}/_{5}$ to $^{1}/_{6}$ of the distance to the point of the lower caudal lobe. The horizontal diameter of the eye is $^{1}/_{4}$ of the length of the head; the distance across the forehead equals $1^{1}/_{2}$ diameter. The depth at occiput slightly exceeds $^{1}/_{2}$ of the length of the head, and is but $^{2}/_{3}$ of the greatest vertical diameter of the body, in front of the ventrals. The length of the pectorals is $^{1}/_{6}$ less than that of the head, which is exceeded by $^{1}/_{4}$ by that of the lower caudal lobe. The upper caudal lobe is $^{2}/_{3}$ of the lower. The ventrals are placed opposite the posterior third of the distance between the apex of the intermaxillaries and the root of the caudal. Head above and back bluish black; lighter, silvery on the sides above the lateral line; rest of the sides, abdomen and opercles silvery with steel-blue reflections; fins hyaline; marginal half of dorsal and caudal minutely dotted with black; sides of lower mandible black. Iris silvery, orbital margin bluish black." Length 250 mm. [After CANTOR, not seen by us].

Habitat: Singapore (KAROLI). — Pinang, Pondicherry.

Note. Nothing is said about the shape of the triangular part of the upper jaw, nor of the position of dorsal and anal fins. It was therefore impossible to give this species a place in our key.

12. Hemirhamphus erythrorhynchus Lesueur.

Hemirhamphus erythrorhynchus Lesueur, Journ. Acad. Nat. Sc. Philad. II. 1821, p. 137.

BLEEKER mentions this fish 3 times (Journ. Ind. Arch. III (1848) 1849, p. 67 & 68; Nat. Tijdschr. Ned. Indië II. 1851, p. 214; Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13de Bijdr. Celebes, p. 47) each time from Makassar, but in his later publications as well as in the „Atlas ichthyologique" no mention whatever is made of this species, which is ranged amongst the doubtful species by GÜNTHER and has been — with a query — very briefly and insufficiently described by KNER (Fische Novara Exp. 1865—1867, p. 324) from Ceylon. We are at a loss which species was meant by BLEEKER. LESUEUR has described a variety of his *erythrorhynchus* too (l. c.) and this variety has been united by CUVIER & VALENCIENNES (Hist. nat. Poissons XIX. 1846, p. 35) with *H. dussumieri* (not with *H. gaimardi* as the authors themself state by mistake on p. 41). It is thus possible that BLEEKER meant *H. dussumieri* by his *erythrorhynchus*.

We have examined, in the Vienna Museum, the specimens mentioned above and described by KNER as *H. erythrorhynchus* Less.?. They seem to us to belong to *H. xanthopterus* C.V. as described by DAY.

13. Hemirhamphus lucens C. V.

Hemiramphus lucens Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 62.

Prof. REINWARDT observed in the Moluccos a species of halfbeak, from which he communicated the following note to CUVIER and VALENCIENNES, who called the species *H. lucens*.

"Rostri apex singulari modo lucet sub aqua, nempe vesicularis oleo fulvo repletus in eum exeunt vasa duo sanguifera et nervi insignia per totam maxillam inferiorem decurrentia. In vesicam quoque exit maxilla ipsa in sitas duas bifida. An *Esox brasiliensis*?. Habitat in mari et in fluminibus vulgo: Julum Julum Bodo".

As no description of the fish is given, *H. lucens* is a nomen nudum.

5. Zenarchopterus Gill.

(GILL, Proc. Acad. Nat. Science Philad. 1863, p. 273).

Very elongate, body more or less compressed. Mandibles

prolonged into a long beak, which has no teeth, except in the part opposite to the intermaxillaries. This beak is bordered by 3 more or less conspicuous folds of the skin, one along each edge and a median one, beginning on the chin. Intermaxillaries forming a triangular plate, which has a band of teeth, similar to that of the lower jaw. The teeth are small and conical. Origin of dorsal far backwards, somewhat before that of anal, which is much shorter than the well developed dorsal. In males some of the dorsal rays are often prolonged and some of the anal rays much enlarged. The articulations of lastnamed have increased in number and are much broadened. From their posterior side a great number of very fine secundary rays take origin, giving to the whole ray the appearance of a bird's feather from which one half of the vexillum has been removed (see fig. 58*c*). Pectorals inserted high up, not longer

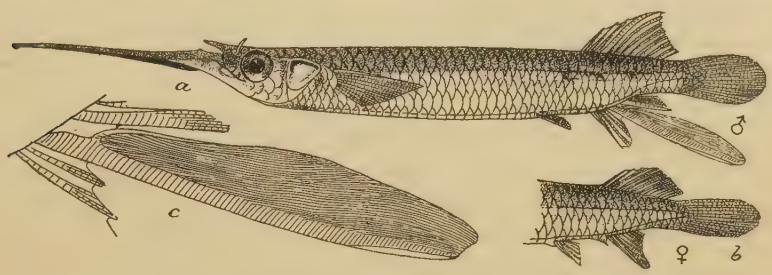

Fig. 58. *Zenarchopterus dispar* C. V.
a male, *b* tailend of female × 2/3, *c* posterior part of anal of male with enlarged and thickened 6th and seventh ray (magnified).

than the head. Ventrals small, nearer to caudal than to head. Caudal rounded or more or less truncate, never forked. Scales moderate, deciduous. The scales on the back overlap each other in two directions. In the anterior part each scale covers with its anterior (cranial) border, part of the scale in front of it, while in the posterior part just the opposite takes place, and the posterior (caudal) border of the scales covers part of the scale behind it, as is usually the case. At the point where these two systems of overlapping meet, there is a central scale, which overlaps the scale in front as well as that behind it and remains uncovered itself. Lateral line running low down. Gillrakers well developed. Third upper pharyngeals ankylosed. Viviparous.

Distribution: East coast of Africa, Madagascar, Sey-

chelles, British India and North China to the Philippines, Indo-australian Archipelago, North Australia and the Pacific Islands.

In rivers and estuaries.

Key to the indo-australian species of Zenarchopterus.

I. Triangular part of upper jaw nearly twice as long as broad [1]).
  A. Entire head 2.5—2.6 in length. Base of ventrals twice nearer to caudal than to frontborder of eye or corner of mouth . . . . . *Z. caudovittatus* p. 164.
  B. Entire head 2—2.3 in length. Base of ventrals nearly or quite twice nearer to caudal than to branchial opening. . . . . *Z. ectuntio* p. 165.

II. Triangular part of upper jaw $1^2/_7$ times as long as broad. Base of ventrals twice nearer to caudal than to hindborder of eye. . . . . *Z. rasori* p. 166.

III. Triangular part of upper jaw about as long as broad.
  A. Anal 10—11.
    1. Head from tip of upper jaw 3—3.3 in trunk. D. 14 . . . . . *Z. novae-guineae* p. 167.
    2. Head from tip of upper jaw 2.3—2.5 in trunk. D. 10—11. . . . . *Z. kampeni* p. 167.
  B. Anal 13—14. Head from tip of upper jaw 3 in trunk. D. 10—12.
    1. Lower jaw beyond upper jaw 5 times in length. *Z. brevirostris* p. 168.
    2. Lower jaw beyond upper jaw 3 times in length. *Z. dux* p. 169.

IV. Triangular part of upper jaw broader than long.
  A. Base of anal 2—2.4 in that of dorsal, 6th and 7th anal ray in males enormously enlarged, often reaching to end of caudal . . . . . *Z. dispar* p. 169.
  B. Base of anal 2.5—3 in that of dorsal, 6th and 7th anal ray in males enlarged, but not so much as to reach to base of caudal . . . . . *Z. buffoni* p. 170.

1. Zenarchopterus caudovittatus (M. Web.)

Hemiramphus (Zenarchopterus) caudovittatus Max Weber, Nova Guinea, V. Livr. 2, 1908, p. 229.

D. 12; A. 12; P. 1.9; V. 1.5; L.l. 45.

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1) Subgenus "Labidorhamphus" Fowler, Proc. Acad. Nat. Sc. Philad. (2) LVII, 1905, p. 493.

Compressed, the breadth of the body going 1.5 in its height. Height 9.1—9.9, 10.5—12.2 in length with caudal. Head from tip of upper jaw to branchial opening 2.7 in trunk. Entire head 2.5—2.6, 2.8—3 in length with caudal. Length of lower jaw beyond extremity of upper jaw 5—6.2 in length, 6—7.1 in length with caudal. Eye twice in postorbital part of head, less than interorbital space. Triangular part of upper jaw nearly twice as long as broad, scaly. Praeorbital more or less rounded, much shorter than eye. Teeth conical, curved backwards, in bands of about three rows in the upper jaw; in the lower jaw bands of smaller teeth, tapering forwards. Origin of anal below 4th dorsal ray. Base of anal almost thrice in that of dorsal. No dorsal rays are enlarged or prolonged. Sixth and 7th anal ray enlarged and swollen but not much prolonged. Posterior rays of anal very small. Pectorals about equal to the distance between the hindborder of the operculum and the corner of the mouth. Ventrals about equal to postorbital part of head, twice nearer to caudal than to frontborder of eye or corner of mouth. Caudal obtusely rounded. Colour of preserved specimens brownish, with a faint lateral silvery band bordered above, below dorsal, and on tail by a black stripe, ending in a dark blotch at base of caudal. Fins hyaline, frontborder of anal and lower border of caudal blackish. Length 160 mm.

Habitat: New Guinea (river Merauke!).

In brackish water.

2. Zenarchopterus ectuntio (Ham. Buch.)

Esox ectuntio Hamilton Buchanan, Fishes Ganges 1822, p. 212, 380.
Hemiramphus amblyurus Bleeker, Verh. Bat. Gen. XXII. (1848) 1849, Madura p. 11. — Ibid. XXIV. 1852, Snoekacht. Vissch. p. 16.
Hemiramphus borneensis Bleeker, Nat. Tijdschr. Ned. Indië I. 1850, p. 273. — Ibid. II. 1851, p. 68. — Verh. Bat. Gen. XXIV. 1852, Snoek. p. 23, 25.
Hemirhamphus Bleekeri Kner, Sitzber. Akad. Wien XXXIX. 1860, p. 537.
Zenarchopterus amblyurus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 160.
Hemirhamphus amblyurus Günther, Cat. Brit. Mus. VI. 1866, p. 273.
Zenarchopterus amblyurus Bleeker, Atl. ichth. VI. 1866—1872, p. 61.
Hemirhamphus ectuntio Day, Fishes of India 4°, 1878—1888, p. 517.
Hemirhamphus ectuntio Vinciguerra, Ann. Mus. Civ. Genova (2) IX. 1890, p. 349.
Hemirhamphus amblyurus Volz, Zool. Jahrb. Abth. Syst. XIX. 1903, p. 395.

D. 1.12—13; A. 2.8—10; P. 8; V. 1.5; L.l. 48—50.

Compressed, the breadth of the body going 1.5—1.6 in its height. Height 11.3—13, 12.8—14.5 in length with caudal.

Head from tip of upper jaw to branchial opening 2.6—3 in trunk. Entire head 2—2.3, 2.2—2.6 in length with caudal. Length of lower jaw beyond extremity of upper jaw 3—4 in length, 3.3—4.6 in length with caudal. Eye more than twice in postorbital part of head, and a little less than interorbital space. Triangular part of upper jaw nearly twice as long as broad, scaly. Praeorbital more or less rounded, much shorter than eye. Teeth conical, the pointed tip curved backwards, in bands of about three rows in both jaws. Origin of anal below 5th dorsal ray. Dorsal about twice as long as anal, rounded in females. In males the 2nd—4th ray are enlarged, much longer than the others. Last rays of anal smaller than the anterior ones. In males the 6th and 7th ray swollen and enlarged. Pectorals about equal to head without snout. Ventrals shorter than postorbital part of head, nearly or quite twice nearer to caudal than to branchial opening. Caudal obtusely rounded. Colour of preserved specimens brownish, with a silvery lateral band, especially conspicuous below dorsal and on tail. Fins hyaline. Length 180 mm. [Several specimens of BLEEKER's collection in the Leiden Museum examined by us].

Habitat: Singapore; Sumatra (Palembang, Banjuasin); Java (Surabaya); Borneo (Banjermassin, Samarinda!, river Riko!, river Baram); Madura. — Siam, Hongkong, Burma, Australia? (Port Darwin [Macleay]).

In rivers and estuaries.

3. Zenarchopterus rasori (Popta)

Hemiramphus rasori Popta, Notes Leyden Mus. XXXIV. 1912, p. 192.

D. 11; A. 9; P. 9; V. 6; L. l. 40.

Compressed, the breadth of the body going $1^3/_5$ in its height. Height $8^1/_2$ in length without lower jaw [1]). Head from tip of upper jaw 3.25 in trunk. Eye 1.8 in postorbital part of head and almost 1.3 in interorbital space. Triangular part of upper jaw $1^2/_7$ times as long as broad. Praeorbital rounded, half as long as eye. Bands of small teeth in the jaws. Origin of anal opposite 4th dorsal ray. Base of anal $3^5/_7$ times in that of dorsal. Anal without modified rays in the single specimen known. Pectorals somewhat shorter than head without snout, longer than postorbital part of head. Ventrals less than half length

1) In the single specimen known the lower jaw is broken.

of pectorals. Base of ventrals twice nearer to caudal than to hindborder of eye. Caudal rounded. Colour of preserved specimen yellowish with a lateral dark stripe, which broadens on the tail and ends in a dark dot at base of caudal. Base of anal with a row of dark points. Length of single specimen known with broken lower jaw 99 mm. [Type seen by us].

Habitat: Rana on island Muna!

Brackish water.

4. Zenarchopterus novae-guineae (M. Web.)

Hemiramphus (Zenarchopterus) novae-guineae Max Weber, Nova Guineae IX. Livr. 4, 1913, p. 553.

D. 14; A. 2.8—9; P. 1.7—8; V. 1.5; L.l. 50—53.

Compressed, the breadth of the body going about 1.5 in its height. Height 9.6—11.3, 11—12.6 in length with caudal. Head from tip of upper jaw to branchial opening 3—3.3 in trunk. Entire head 2.3—2.4, 2.5—2.8 in length with caudal. Length of lower jaw beyond extremity of upper jaw 3.9—4.8 in length, 4.3—5.5 in length with caudal. Eye 1.5 to nearly twice in postorbital part of head, equal to or somewhat smaller than interorbital space. Triangular part of upper jaw scarcely longer than broad at its base, scaly. Praeorbital rounded in front, one half or two thirds of diameter of eye. Teeth very small, pointed, forming bands. The band in the upper jaw is of constant breadth, that of the lower jaw tapers forward. Origin of anal below third or fourth dorsal ray. Dorsal about thrice as long as anal, convex, the third, fourth and fifth rays being the longest. None of the rays thickened. Anal convex, the 6th ray swollen in males, posterior rays smaller than the others. Pectorals as long as postorbital part of head or somewhat longer. Ventrals short, less than half length of pectorals. Origin of ventrals about twice nearer to base of caudal than to eye. Caudal more or less truncate. Colour of preserved specimens yellowish, with a silvery lateral band, bordered above by a black stripe and broadest in the postanal part of the body. Fins hyaline, caudal and dorsal dusky. Length 240 mm.

Habitat: New Guinea (Lorentz river!, Kloofbivak!).

5. Zenarchopterus kampeni (M. Web.)

Hemiramphus (Zenarchopterus) Kampeni Max Weber, Nova Guinea IX. Livr. 4, 1913, p. 554.

? *Hemirhamphus Buffonis* Hase, Jen. Zeitschr. f. Naturw. Bd. LI. 1914, p. 541 (nec C. V.).

D. 10—11; A. 11; P. 1.8; V. 1.5; L.l. about 48.

Compressed, the breadth of the body going nearly 1.5 in its height. Height 8.8—10.8, 9.8—12.2 in length with caudal. Head from tip of upper jaw to branchial opening 2.3—2.5 in trunk. Entire head 2—2.3, 2.3—2.5 in length with caudal. Length of lower jaw beyond extremity of upper jaw 3.8—4.5 in length, 4.3—5 in length with caudal. Eye about twice in postorbital part of head, somewhat less than interorbital space. Triangular part of upper jaw scarcely longer than broad at its base, scaly. Praeorbital rounded in front, one half or nearly two thirds of diameter of eye. Teeth small, in bands of about 5 rows in both jaws. Origin of anal below third dorsal ray. Dorsal 2.5 times longer than anal, convex. Fourth, fifth and sixth ray prolonged — at least in males. Sixth, seventh and eighth ray of anal much thickened in males. Pectorals equal to head without snout. Ventrals short, less than half length of pectorals, their origin about twice nearer to base of caudal than to eye. Caudal probably obliquely truncate. Colour of preserved specimens yellowish, with a more or less distinct silvery lateral band, bordered above by a black stripe and most distinct in postanal part of the body. Fins hyaline, caudal and dorsal dusky. Length 156 mm.

Habitat: New Guinea (Kaiserin Augusta river!).

6. **Zenarchopterus brevirostris** (Gthr.)

Hemirhamphus dispar Kner, Sitzber. Akad. Wien XXXIX. 1860, p. 537 (nec C.V.)
Hemirhamphus brevirostris Günther, Cat. Brit. Mus. VI. 1866, p. 274.
Zenarchopterus brevirostris Bleeker, Atl. ichth. VI. 1866—1872, p. 64.

D. 10—11; A. 13; P. 9.

"Scales large. The length of the head is two-fifths of the total (without caudal), that of the prominent part of the lower jaw one-fifth. Upper jaw as broad as long. The diameter of the eye is one-half of the length of the postorbital part of the head. Ventral considerably nearer to the root of the caudal than to that of the pectoral. The male has the fourth ray of the dorsal fin and the sixth of the anal prolonged and thickened; the latter, besides, being provided with additional filamentous rays. Caudal rounded. Sides with a silvery band." [After GÜNTHER, not seen by us].

Habitat: East-Indian Archipelago.

7. Zenarchopterus dux Seale.

Zenarchopterus dux Seale, Philippine Journ. Sci. V, No. 4, 1910, p. 267.

"Head, from tip of upper jaw, 4 to end of caudal vertebra; lower jaw, beyond the upper, 3 to end of vertebra; posterior margin of opercle midway between tip of lower jaw and end of caudal vertebra; dorsal 12; anal 14; the 6th ray modified into an intromittent organ; scales in lateral series 41, about 45 in lateral line, 6 in vertical series; eye 3.75 in head; snout 3.1; width of exposed upper jaw equal to its length; origin of anal midway between end of caudal vertebra and origin of ventrals, being below fifth dorsal ray; length of ventrals 2.50 in head; length of pectorals 2.50 in head; caudal truncate, its length equal to distance from posterior end of upper jaw to end of opercle; body covered with smooth deciduous scales.

Color yellowish with a silver stripe along side which is bordered above with dark green. A dusky wash on dorsal and caudal, the anal with a distinct dusky blotch anteriorly. Length 150 mm." [After SEALE, not seen by us].

Habitat: Borneo (Sandakan).

8. Zenarchopterus dispar (C.V.) [Fig. 58, p. 163].

Hemirhamphus dispar Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 58.
Hemirhamphus dispar Bleeker, Nat. Tijdschr. Ned. Indië VI. 1854, p. 498.
Zenarchopterus dispar Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 164.
Hemirhamphus dispar Günther, Cat. Brit. Mus. VI. 1866, p. 274.
Zenarchopterus dispar Bleeker, Atl. ichth. VI. 1866—1872, p. 63.
Hemirhamphus dispar Day, Fishes of India, 4°. 1878—1888, p. 517.
Zenarchopterus vaisiganis Jordan & Seale, Bull. Bureau Fish. Wash. XXV. 1906, p. 208.
Zenarchopterus dispar Jordan & Seale, Bull. Bureau Fish. Wash. XXVI. 1907, p. 9.
Zenarchopterus dispar Günther, Fische der Südsee, Heft VIII. 1909, p. 358.
Zenarchopterus dispar Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard Coll. XXVI. 1911, p. 252.

D. 10—11; A. 11—12; P. 1.9; V. 1.5; L.l. ± 40.

Compressed, the breadth of the body going somewhat more or less than 1.5 in its height. Height 9—12, 10—13.8 in length with caudal. Head from tip of upper jaw to branchial opening 2.4—3 in trunk. Entire head 1.9—2.1, 2.2—2.3 in length with caudal. Length of lower jaw beyond extremity of upper jaw about 3—3.5 in length, 3.5 to about 4 in length with caudal. Eye 1.5—1.7 in postorbital part of head and 1.2—1.6 in interorbital space. Triangular part of upper jaw somewhat broader than long, scaly above. Praeorbital more or less rounded,

much shorter than eye. Teeth small, conical, in bands, the band in the upper jaw is broader than that in the lower jaw. Origin of anal about below third dorsal ray. Base of anal 2—2.4 in length of dorsal. Dorsal rounded in females, in males more pointed, the 4th, 5th and 6th ray being prolonged and the 4th or 5th moreover thickened. Anal of females slightly concave, in males the 6th and 7th ray are enormously enlarged and thickened, especially the 6th ray, which often reaches to the end of the caudal. Pectorals equal to or somewhat longer than head without snout. Ventrals half as long as pectorals. Base of ventrals about twice nearer to caudal than to corner of mouth. Caudal obtusely rounded. Colour of preserved specimens brownish above, lighter below, with a silvery lateral band bordered above by a black line, which broadens to a regular band below the dorsal. Fins more or less dusky. Length 165 mm.

Nom. indig.: Ikan kadjangan (Malay Bantam).

Habitat: Sumatra (Benkulen, Trussan, Padang, Siboga, Upper Langkat); Simalur!; Engano; Nias!; Batu Islands; Biliton; Java (Batavia, Labuan); Borneo (Balikpapan!); Celebes (Tanawanko); Sangir Islands; Ambon!; Nusa Laut!; Goram; Kei-Islands; Waigeu; New Guinea. — Torres Straits, Caroline Islands, Fiji Islands, Guam, Philippines, Siam, Andamans, British India, Seychelles, Madagascar.

In sea and rivers.

9. Zenarchopterus buffoni (C.V.)

Hemiramphus Buffonis Cuvier & Valenciennes, Hist. Nat. Poissons XIX. 1846, p. 48.
Hemiramphus Buffonis Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 711.
Hemirhamphus striga Blyth, Journ. Asiat. Soc. Bengal 1859, XXVII. p. 288.
Zenarchopterus buffonis Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 162.
Hemirhamphus buffonis Günther, Cat. Brit. Mus. VI. 1866, p. 273.
Zenarchopterus Buffoni Bleeker, Atl. ichth. VI. 1866—1872, p. 62.
Hemirhamphus buffonis Day, Fishes of India 4°, 1878—1888, p. 516.
Zenarchopterus buffonis Fowler, Proc. Acad. Nat. Sc. Philadelphia (2) LVII. 1905, p. 494.
Zenarchopterus buffonis Seale, Philippine Journ. Science V. 1910, p. 267.

D. 11—12; A. 11—12; P. 1.8—9; V. 1.5; L.l. 40—45.

Compressed, the breadth of the body going 1.3—1.6 in its height. Height 7.5—10, 9.7—13 in length with caudal. Head from tip of upper jaw to branchial opening 2.4—3 in trunk. Entire head a little more or less than 2, 2.3—2.4 in length

with caudal. Length of lower jaw beyond extremity of upper jaw 3.4—3.6 in length, about 4 in length with caudal. Eye 1.5—1.9 in postorbital part of head, a little more than once — 1.5 in interorbital space. Triangular part of upper jaw somewhat broader than long, scaly above. Praeorbital much higher than long and much shorter than eye. Teeth conical, curved backwards, in bands of about 4 rows in each jaw. Origin of anal below 4th dorsal ray. Base of anal 2.5—3 in length of dorsal. Dorsal rounded, none of the rays prolonged, the fourth sometimes somewhat thickened. In males the 6th and 7th rays of anal are somewhat enlarged and thickened, but not so much as to reach to the base of the caudal. Pectorals about equal to head without snout. Ventrals half as long as pectorals, about twice nearer to caudal than to frontborder of eye. Caudal obtusely rounded. Colour of preserved specimens brownish with a distinct silvery lateral band, bordered above by a faint black line. A black line runs along the middle of upper side of the lower jaw and is continued backwards to between the eyes, forming a median longitudinal stripe on the triangular part of the upper jaw. Distal part of dorsal and often also of anal black. Caudal more or less dusky. Length 230 mm.

Habitat: Singapore; Sumatra (Benkulen, Priaman, Deli); Banka; Nias!; Simalur!; Java (Batavia!, Semarang!, Surabaya!); Java Sea!; Borneo (Banjermassin, Stagen!, Balikpapan!, Sandakan, Baram); Flores!; Celebes (Makassar!, Maros!, mouth of river Tello!, Menado); Batjan; Ceram; Ambon!; Goram; Aru Islands; Waigeu!; New Guinea (Segaar Bay, Ramu). — Philippines, Malay Peninsula, Bay of Bengal, Andamans, Bombay.

In sea, estuaries and rivers.

6. Arrhamphus Günther.

(Günther, Cat. Brit. Mus. VI. 1866, p. 276).

Elongate, compressed. Mandibles somewhat projecting beyond the upper jaw, but not prolonged into a long beak. Intermaxillaries forming a triangular plate, which has a band of teeth, similar to that of the lower jaw. Teeth in narrow or broader bands in both jaws, minute or moderate and often tricuspid. Origin of dorsal far backwards. Origin of anal opposite to that of dorsal or somewhat more backwards. Pectorals inserted high up, not as long as head. Ventrals nearer to head

than to base of caudal. Caudal fin forked. Scales large or moderate, rather deciduous. Lateral line running low down. Gillopenings wide. Gillrakers present.

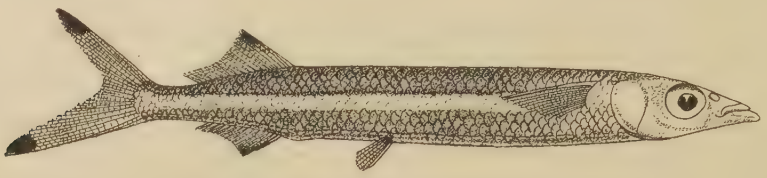

Fig. 59. *Arrhamphus brevis* (Seale). × 5/7.

Distribution: New Zealand?, Australia, Indo-australian Archipelago, Palawan Islands.

In freshwater (and sea?).

1. **Arrhamphus brevis** (Seale) [Fig. 59, p. 172].

Oxyporhamphus brevis Seale, Philippine Journ. of Science IV. 1909, p. 495.

D. 15—17; A. 15; P. 1.11; V. 1.5; L.l. about 58.

Somewhat compressed, the breadth of the body going about 1.4 in its height. Height 7.5—8.5, about 9 in length with caudal. Head 4.1—4.4, about 5 in length with caudal. Upper profile of head sloping gradually down from eye to tip of snout. Eye 3.75 in head, equal to interorbital space, shorter than snout, 1.25 in postorbital part of head. Teeth rather large, conspicuously tricuspid, in about 4—5 rows in both jaws. Triangular part of upper jaw, formed by intermaxillaries, broader than long. Mandible projecting by about the length of the pupil beyond snout. Origin of anal opposite to third ray of dorsal. Dorsal and anal concave, the anterior rays being the longest. Pectorals 1.75 in head. Ventrals 2.45 in head, their origin midway between base of caudal and hindborder of praeoperculum. Caudal forked. Colour in alcohol specimens yellowish. Sides with a narrow silvery band, bordered above by a dark line. Dorsal, anal and caudal broadly tipped with black. A black spot on upper base and axil of pectorals. Length 147 mm.

Habitat: Indo-australian Archipelago! — Palawan Islands.

Note. Among specimens of *Hemirhamphus melanurus* C.V. in BLEEKER's collection in the Leiden Museum we found a specimen of the species described above. There was no locality on the label, but it is without doubt that the specimen came from the Indo-australian Archipelago.

2. Fam. Exocoetidae.

Elongate, more or less compressed. Maxillaries free from or merely adherent to intermaxillaries, which do not form a triangular expansion, but have a straight transverse anterior margin. The symphysis of the lower jaw is sometimes prolonged into a small knob, which projects somewhat before the upper jaw, but generally the jaws are subequal. Teeth rather small or minute, rarely tricuspid, in the jaws and sometimes on palatines, by exception also on vomer, pterygoids and tongue. Pectorals inserted rather high up, very long, forming an organ of flight and consisting of many rays, the first or the first and second of which are undivided. Ventrals short, moderate or long, in the last case assisting the pectorals in suspending the fish in the air. Dorsal far back, beginning above, or behind origin of anal; both fins of about equal length or the dorsal longer than the anal. Caudal deeply forked, the lower lobe the longer. Scales large or moderate. Lateral line running low down. Gillopenings wide, gillmembranes not united with isthmus. Third upper pharyngeals simply coalescent, the plate readily separating into its two components.

Distribution: All tropical and subtropical seas, penetrating more or less into temperate seas during the warm season.

Key to the indo-australian genera of Exocoetidae.

I. A large patch of teeth on vomer. Teeth on tongue. L. l. 38—40 . . . . . *Parexocoetus* p. 173.

II. No teeth on vomer or tongue. Teeth on palatines present or absent. L.l. more than 40.

1. Pectorals comparatively short, not reaching ventrals. Lower jaw prominent, with a symphysial process. Ventrals shorter than head . . . . . *Evolantia* p. 175.

2. Pectorals reaching much farther than base of ventrals.

a. Ventrals much shorter than head, much nearer to snout than to base of caudal . . . . . *Exocoetus* p. 177.

b. Ventrals as long as or longer than head, much nearer to caudal than to snout . . . . . *Cypsilurus* p. 179.

1. **Parexocoetus** Bleeker.

(Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 107 and 126).

Elongate, compressed. Mandibles with a long triangular

symphysial knob, which projects beyond the upper jaw. Jaws protractile. Teeth in jaws, on vomer, palatines, pterygoids and tongue. Dorsal opposite to anal, high, convex. Pectorals moderately developed, reaching to middle of dorsal. Ventrals moderately developed, their origin about midway between point of snout and base of caudal. Scales large. Lateral line running low down. Gillrakers well developed. Gillopenings wide.

Distribution: Indic, Pacific and Atlantic.

1. Parexocoetus brachypterus (Rich.) [Fig. 60, p. 175].

Exocoetus brachypterus (Solander Manuscr.) Richardson, Report British Assoc. at Cambridge 1845, London 1846, p. 265.
Exocoetus mento Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 124.
Exocoetus hillianus Gosse, Nat. Sojourn Jamaica 1851, p. 11.
Exocoetus mento Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekacht. Vissch. p. 21.
Parexocoetus mento Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 126. — Atl. ichth. VI. 1866—1872, p. 77.
Exocoetus brachypterus Günther, Cat. Brit. Mus. VI. 1866, p. 280.
Exocoetus mento Günther, l. c. p. 281.
Exocoetus hillianus Günther, l. c. p. 284.
Exocoetus atrodorsalis Günther, Ann. Mag. Nat. Hist. XX (3) 1867, p. 67. — Zool. Record 1871, p. 109.
Exocoetus gryllus Klunzinger, Abh. zool.-bot. Gesellsch. Wien, XXI. 1871, p. 586.
Exocoetus hillianus Lütken, Vidensk. Meddel. naturh. Foren. Kjøbenhavn, 1876, p. 397. — Résumé p. 104.
Exocoetus mento Day, Fishes of India 4°, 1878—1888, p. 520.
Parexocoetus mesogaster Jordan & Evermann, Fishes North America I. 1896, p. 728.
Parexocoetus brachypterus Jenkins, Bull. U. S. Fish Comm. XXII. 1904, p. 435.
Parexocoetus brachypterus Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. 1905, p. 131.
Parexocoetus mento Fowler, Proc. Acad. Nat. Sci. Philadelphia (2) LVII. 1905, p. 494.
Parexocoetus mento Jordan & Seale, Bull. Bur. of Fisheries Wash. XXVI. 1907, p. 9.
Parexocoetus mento Jordan & Richardson, Bull. Bur. of Fisheries Wash. XXVII. 1908, p. 243.
Exocoetus brachypterus Günther, Fische der Südsee, Heft VIII. 1909, p. 362.
Parexocoetus mento Max Weber, Siboga-Expeditie, Fische. 1913, p. 128.

D. 10—11; A. 10—11; P. 1.12; V. 6; L.l. 38—40.

Compressed, the breadth of the body going 1.5 in its height. Height 4.5 to nearly 5, 5.5—6 in length with caudal. Head 3.8 to somewhat more than 4, about 5 in length with caudal. Eye 2.5—3, somewhat less than postorbital part of head, which is equal to the somewhat convex interorbital space. Snout much shorter than eye. Jaws protractile, the lower one with a bony triangular symphysial knob, which projects beyond the

upper jaw and rarely bears two small barbels. Teeth minute, conical, in several rows in the jaws. A large triangular patch, the point of which is directed backwards on the vomer, and elongated small patches on both sides on the palatines and pterygoids. Tongue with an oblong patch of teeth. Origin of dorsal opposite to that of anal, separated by 17 scales from occiput. Dorsal high, the middle rays, which are the longest, as long as or even longer than head. Anal much lower, but as long as dorsal. Pectorals reaching to middle of dorsal. Ventrals shorter than or as long as head, reaching to anus, their origin midway between point of snout and base of caudal or a little nearer to the latter. Caudal deeply forked. Brownish above,

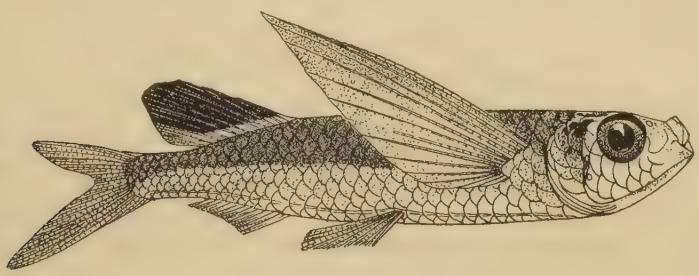

Fig. 60. *Parexocoetus brachypterus* (Rich.) n. s.

silvery below. A more or less conspicuous dark patch at base of caudal. In young specimens sometimes two dark blotches on each side, one below the origin and the other below the middle of the dorsal. Pectorals densely covered with small oblong black spots, especially in their hinderpart, giving to the fin a blackish appearance sometimes wanting in preserved specimens. Upper half of dorsal deep black. Ventrals and anal hyaline, blackish in young specimens. Caudal dusky. Length 185 mm.

Habitat: Simalur!; Nias!; Banka; Java (Batavia!, Semarang!, Panarukan!); Java-sea!; Strait Sunda!; Borneo; Celebes (Makassar!, Badjoa); Sangir Islands; Ternate; between Fau and Gébé!; Flores!; Timor!; Adonare!; New Guinea. — From Red Sea and Natal to Sandwich Islands, ranging north to China; West Atlantic, north to Newport.

2. **Evolantia** Snodgrass & Heller.

[Snodgrass & Heller, Proc. Wash. Acad. Sci. V. 1903, p. 189].

Elongate, compressed. Mandibles with a distinct symphysial

process, projecting beyond the upper jaw. Teeth in the jaws, none on the palate or on tongue. Dorsal beginning somewhat before anal and somewhat longer than lastnamed fin. Pectorals comparatively short, not reaching ventrals. Ventrals short, nearer to base of caudal than to snout. Scales moderate. Lateral line running low down. Gillrakers well developed, lancet-shaped, finely dentated along their frontborder.

Distribution: That of the single species known.

1. **Evolantia micropterus** (C. V.) [Fig. 61, p. 176].

Exocoetus micropterus Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 127.
Exocoetus micropterus Bleeker, Act. Soc. Sc. Indo-neerl. I. Beschr. vissch. Amboina 1856, p. 63.
Cypsilurus micropterus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 128.
Exocoetus micropterus Günther, Cat. Brit. Mus. VI. 1866, p. 279.
Exocoetus micropterus Bleeker, Atl. ichth. 1866—1872, p. 77.
Exocoetus micropterus Lütken, Vidensk. Meddel. naturh. Foren. Kjøbenhavn. 1876, p. 396, (résumé p. 103).
Exocoetus micropterus Day, Fishes of India 4°, 1878—1888, p. 518.
Evolantia microptera Jenkins, Bull. U. S. Fish. Comm. XXII. (1902) 1904, p. 434.
Evolantia microptera Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 130.
Exocoetus micropterus Günther, Fische der Südsee, Heft VIII. 1909, p. 361.

D. 13—16; A. 14—16; P. 1.10—11; V. 6; L.l. 48—50.

Compressed, the breadth of the body going about 1.5 in its height. Height about 6—6.3, 7.5—8 in length with caudal. Head 4.3—4.5, 5.3 to nearly 6 in length with caudal. Eye 3.3, about 1.5 in postorbital part of head and about equal to interorbital space, which is not flat and has two grooves, converging anteriorly. Snout shorter than eye. Lower jaw prominent, with a distinct symphysial processus, bearing two barbels, which

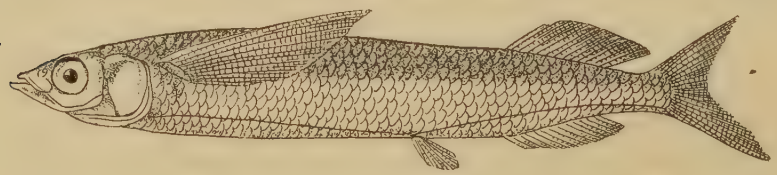

Fig. 61. *Evolantia micropterus* (C. V.) × 5/6.

are shorter than eye. It seems that these barbels are sometimes missing. Teeth very small, conical, pointed, simple, partly in 2 rows in the jaws. No teeth on the palate. Dorsal beginning somewhat before anal; somewhat longer than anal;

separated by about 30 scales from occiput. Pectorals less than twice as long as head, not reaching ventrals. Ventrals about half as long as head, their origin about midway between tip of snout and end of caudal, more or less nearer to caudal than to branchial opening. Caudal deeply forked. Colour of preserved specimens brown above, silvery below; pectorals blackish, broadly edged with whitish below and less so above, other fins more or less darker. Length 175 mm. [A specimen of unknown locality in the museum of Amsterdam examined by us].

Habitat: Ambon; Buru. — New Ireland, Hawaiian Islands, Australia, New Zealand?, Galapagos Islands, tropical and subtropical Atlantic.

3. Exocoetus Linné.

(Linné, Syst. Naturae Ed. X*a* 1758, p. 316).

Elongate, compressed. Jaws equal. Very small teeth in the jaws. Palate and tongue edentulous. Dorsal beginning about opposite to anal and about as long as lastnamed fin. Pectorals long, reaching base of caudal or nearly so. Ventrals short,

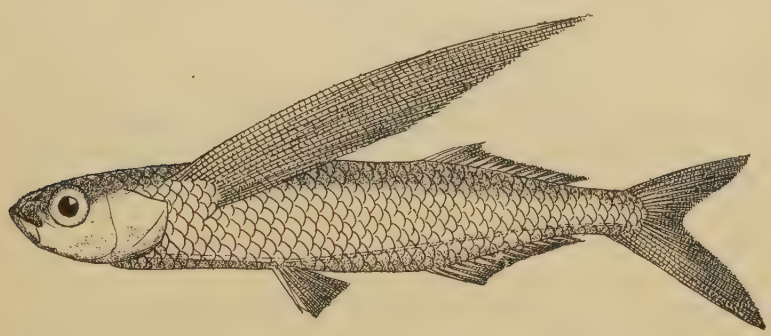

Fig. 62. *Exocoetus volitans* L. × 3/5.

their origin much nearer to tip of snout than to base of caudal. Scales rather large. Lateral line running low down. Gillrakers well developed. Gillopenings wide.

Distribution: Tropical and subtropical parts of Indic, Pacific and Atlantic.

1. Exocoetus volitans L. [Fig. 62, p. 177].

Exocoetus volitans Linné, Syst. Nat. Ed. X*a*, 1758, p. 316, Ed. XII*a*, 1766, p. 520.
Exocoetus evolans Linné, Syst. Nat. Ed. XII*a*, 1766, p. 521.

Exocoetus evolans Bloch, Ausländ. Fische IX. 1795, p. 14.
Exocoetus volitans Lacépède, Hist. nat. Poissons V. 1803, p. 401.
Exocoetus evolans Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 138.
Exocoetus volans Richardson, Report 15th Meeting British Assoc. (1845) 1846, p. 264.
Exocoetus evolans? Kner, Novara Exp. Fische 1865—1867, p. 326.
Exocoetus evolans Steindachner, Sitzber. Akad. Wien LIII. 1866, p. 470.
Exocoetus evolans Günther, Cat. Brit. Mus. VI. 1866, p. 282.
Exocoetus obtusirostris Günther, l. c. p. 283.
Exocoetus evolans Bleeker, Atl. ichth. VI. 1866—1872, p. 69.
Exocoetus evolans et *obtusirostris* Lütken, Vidensk. Meddel. Naturh. Foren. 1876, p. 395 (résumé p. 102).
Exocoetus evolans Day, Fishes of India 4°, 1878—1888, p. 519.
Exocoetus volitans Lönnberg, Bidr. Svenska Akad. XXII. 1896, No. 1, p. 25.
Halocypselus evolans Jordan & Evermann, Fishes North and Middle America 1, 1896, p. 729.
Exocoetus volitans Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 132 [nec syn. nec fig.].
Exocoetus evolans Günther, Fische der Südsee, Heft VIII. 1909, p. 363.

D. 13—15; A. 13—14; P. 1.13—14; V. 1.5; L.l. 40—43; L. tr. [1] $\frac{7}{1}$.
$\frac{}{2}$

Somewhat compressed, the breadth of the body going about 1.5 in its height. Height 5—5.7, 6.5—7.3 in length with caudal. Head 3.8—4, 5—5.3 in length with caudal. Eye 3—3.5, longer than snout, about 1.5 in postorbital part of head and about 1.3 in the somewhat convex interorbital space. No chinbarbel. Teeth very small and scarcely conspicuous. Origin of dorsal and anal opposite to each other or nearly so, that of dorsal separated by 17—20 scales from occiput. Pectorals reaching base of caudal or nearly so. Ventrals equal to or a little longer than postorbital part of head, their origin much nearer to tip of snout than to base of caudal. Caudal deeply forked. Colour of preserved specimens brownish above, silvery below. Fins yellowish, pectorals blackish, with the posterior and upper border white. Length 240 mm.

Habitat: Java!; Java Sea!; West of Saleyer!. — Tropical and subtropical parts of Indic, Pacific and Atlantic, reaching far into temperate regions. Apparently rather rare in the indo-australian Archipelago.

1) Between D. and A.

Note. Under the name *Exocoetus javanicus* K. v. H. — probably a manuscript name of KUHL and VAN HASSELT — BLEEKER mentions a flying fish in Nat. & Geneesk. Arch. Ned. Ind. II. 1845, p. 512, one of the first ichthyological papers of the author. In his later papers he never mentioned the name again and as no description is given, *Ex. javanicus* has to stand as a nomen nudum.

4. Cypsilurus Swainson.

(SWAINSON, The Nat. Hist. of Fishes etc. II. 1839, p. 296).

Elongate, more or less compressed. Jaws equal. Teeth small or very small, in the jaws and sometimes on the palatines. No teeth on vomer, pterygoids and tongue. Dorsal beginning opposite to or far before that of anal, generally longer than lastnamed fin. Pectorals long, reaching base of caudal or not so far. Ventrals well developed, often very long, their origin

Fig. 63. *Cypsilurus poecilopterus* (C. V.) × 1/2.

much nearer to base of caudal than to tip of snout. Scales large or moderate. Lateral line running low down. Gillrakers moderately developed. Gillopenings wide.

Distribution: Tropical and subtropical parts of Indic, Pacific and Atlantic.

Key to the indo-australian species of Cypsilurus.

I. Second pectoral ray divided, first undivided.

A. Origin of anal opposite to that of dorsal (*Exonautes*).

1. Palate edentulous. P. 1.14—15, without distinct hyaline band . . . . . *C. oxycephalus* p. 181.
2. A few teeth on palatines. P. 1.16, with a distinct hyaline band. . . . . *C. speculiger* p. 181.

B. Origin of anal far behind that of dorsal (*Cypsilurus* s. str.).

i. Pectorals dark with a hyaline transverse band.

1. Head and body without bars.

a. D. 13. A. 8. Ventrals white, the middle rays greyish . . . . . *C. arcticeps* p. 182.

b. D. 14—16. A. 9—11. Distal half of ventrals and posterior half of dorsal black. . . . . *C. nigricans* p. 183.

c. D. 13. A. 10—12. Dorsal and ventrals uniform, dusky . . . . . *C. altipennis* p. 184.

2. Head and body with 6 brown cross bands. *C. hexazona* p. 185.

ii. Pectorals with rounded spots.

1. Two barbels at corner of mouth . . . . . *C. bilobatus* p. 185.
2. No barbels.

a. A. 7—8. Distance of origin of dorsal from first rudimentary rays of caudal much more than length of head. 25—27 scales before dorsal. Teeth tricuspid . . . . . *C. poecilopterus* p. 186.

b. A. 10. Distance of origin of dorsal from first rudimentary rays of caudal more than length of head. About 40 scales before dorsal. Teeth simple. . . . . *C. atrisignis* p. 187.

c. A. 10. Distance of origin of dorsal from first rudimentary rays of caudal equal to or scarcely longer than head. About 30 scales before dorsal. Teeth simple. . . . . *C. spilopterus* p. 187.

iii. Pectorals without band or spots.

1. A broad ribbon-like barbel at symphysis of lower jaw . . . . . *C. naresi* p. 188.
2. No barbels.

a. Teeth on the palatines.

1. Origin of ventrals nearer to branchial opening than to caudal.

α. Teeth tricuspid. A. 8—9. L.l. 42—45. Dorsal without black patch . . . . . *C. oligolepis* p. 189.

β. Teeth simple. A. 10—11. L. l. 48. Dorsal with a black patch. . . . . *C. bahiensis* p. 190.

2. Origin of ventrals nearer to caudal than to branchial opening . . . . . *C. opisthopus* p. 191.

b. No teeth on palate.

a. All fins blackish. Size small, probably juvenile form of some other species. Height about 5 . . . . . *C. nigripennis* p. 192.

β. Fins not blackish. Height 4—4.5 . . . *C. brevis* p. 192.

II. Second pectoral ray undivided as the first . . . . . *C. rondeleti* p. 193.

1. Cypsilurus oxycephalus (Blkr.)

Exocoetus oxycephalus Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 771. — Ned. Tijdschr. Dierk. III. 1866, p. 124. — Atl. ichth. VI. 1866—1872, p. 75.
Exocoetus oxycephalus Günther. Cat. Brit. Mus. VI. 1866, p. 294.
Exonautes oxycephalus Ogilby, Ann. Queensl. Mus. No. 9, part 1, 1908, p. 5.

D. 10—11; A. 11; P. 1.14—15; V. 6; L.l. 50—56; L. tr. $\frac{7}{1}$.

Somewhat compressed, the breadth of the body going about 1.3 in its length. Height 5—5.6, 6.5 to more than 7 in length with caudal. Head 4—4.3, somewhat more than 5 to 5.5 in length with caudal. Eye 3—3.4, less than postorbital part of head, which is equal to the somewhat concave interorbital space. Snout somewhat less than eye. Teeth comparatively well developed, simple, conical, pointed, in a single row in the jaws. Palate edentulous. Origin of dorsal above that of anal, separated by 32—35 scales from occiput; its distance from first rudimentary ray of caudal equal to or a little less than length of head. Pectorals reaching to posterior part of dorsal or farther. Ventrals somewhat shorter or longer than head, reaching to middle of anal or somewhat farther, their origin about midway between branchial opening and base of caudal. Caudal deeply forked. Colour of preserved specimens brownish or bluish above, silvery below. Pectorals somewhat dusky, deepening in the posterior half and near the axil into blackish, thus forming an indication of a light transverse band. Middle rays of ventrals and caudal dusky, other fins hyaline. Length 225 mm.

Habitat: Java (Batavia!); Java-sea!; Celebes (Makassar!); Moluccos!; Aru Islands. — Torres Straits.

2. Cypsilurus speculiger (C.V.)

Exocoetus speculiger Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 94.
Exocoetus speculiger Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 122. — Atl. ichth. VI. 1866—1872, p. 76.
Exocoetus speculiger Günther, Cat. Brit. Mus. VI. 1866, p. 287.
Exocoetus affinis Günther, ibid. p. 288.

Exocoetus speculiger Lütken, Vidensk. Meddel. naturh. Foren. 1876, p. 403 (résumé p. 109).
Exocoetus volitans Jordan & Evermann, Fishes N. America 1, 1895, p. 734 (nec L.).
Cypsilurus speculiger Jordan & Seale, Bull. Bureau Fish. XXV. 1906, p. 209.
Exocoetus speculiger Günther, Fische d. Südsee, Heft VIII, 1909, p. 336.
Exonautes speculiger Mc Culloch, Zool. results "Endeavour" Fishes, Part 1. 1911, p. 30.
Cypselurus speculiger Mc Culloch, Check-list of fish of N. S. Wales, Prt II. 1919, p. 30.

D. 11—12; A. 11—12; P. 1.16; V. 6; L.l. circa 50; L. tr. $\frac{7—8}{1\frac{1}{2}}$.

Rather compressed, the breadth of the body going about 1.5 in its height. Height 5.7—6.5, 7—8 in length with caudal. Head a little more than 4, 5.3—5.5 in length with caudal. Eye 3, less than postorbital part of head, which is equal to the somewhat concave interorbital space. Snout somewhat less than diameter of eye. Teeth comparatively rather well developed, simple, conical, pointed, in about three rows in the jaws; a few only on each side on the palatines. Origin of dorsal opposite to that of anal, separated by 28—32 scales from occiput; its distance from first rudimentary caudal ray a little more or less than length of head. Pectorals reaching to end of dorsal or not so far or even surpassing it. Ventrals longer than head, reaching to about middle of anal or farther, their origin a little nearer to base of caudal than to hindborder of praeoperculum. Caudal deeply forked. Colour of preserved specimens brownish above, silvery below. Pectorals blackish, especially in the posterior half, with an oblique hyaline band across the lower half and a reddish patch and a white hindmargin near the axil. Other fins yellowish, caudal dusky. Length 300 mm.

Habitat: Singapore; Sumatra; Java-sea!; Straits of Sunda; Island Lamukutan! (HALLIER); Ambon; Gébé; Banda. — Pacific, south to Tasmania and New Zealand; Indic; Atlantic.

3. Cypsilurus arcticeps (Gthr.)

Exocoetus arcticeps Günther, Cat. Brit. Mus. VI. 1866, p. 289.
Exocoetus arcticeps Macleay, Proc. Linn. Soc. N. S. Wales 1883, p. 278.
Cypsilurus arcticeps Jordan & Seale, Bull. Bur. Fish. XXV. 1906, p. 211.

D. 13; A. 8; P. 1.17; V. 6; L.l. ± 47; L. tr. $\frac{8}{3}$.

Somewhat compressed, the breadth of the body going about 1.5 in its height. Height 5.5, almost 7 in length with caudal.

Head 3.9, about 5 in length with caudal. Eye 3, equal to concave interorbital space and somewhat less than postorbital part of head. Snout 1.4 in eye. Teeth in several rows in jaws, none on palate. Origin of anal about opposite to 6th dorsal ray. Origin of dorsal separated by about 29 scales from occiput. Pectorals reaching to middle of anal. Ventrals much longer than head, reaching a little farther than pectorals, their origin midway between hindborder of eye and base of caudal. Caudal deeply forked. Colour of alcohol specimen brownish above, golden below. Pectorals with a broad oblique white band across its lower half, and with a broad whitish edge. Ventrals white, the middle rays greyish. Length 215 mm. [Description made after the type, seen by us in the British Museum].

Habitat: New Guinea. — China, Japan.

4. Cypsilurus nigricans (Benn.)

Exocoetus nigricans Bennett, Whaling Voyage II. 1840, p. 287.
Exocoetus bicolor Cuvier & Valenciennes, Hist. nat. Poissons, XIX. 1846, p. 111.
Exocoetus spilopus Cuvier & Valenciennes, l. c. p. 118.
Exocoetus bicolor Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 132.
Exocoetus nigricans Günther, Cat. Brit. Mus. VI. 1866, p. 290.
Exocoetus nigricans Bleeker, Atl. ichth. VI. 1866—1872, p. 73.
Exocoetus spilopus Lütken, Vidensk. Meddel. naturh. Foren. 1876, p. 401 (résumé p. 107).
Exocoetus nigricans Jordan & Evermann, Fishes N. America 1, 1896, p. 737.
Exocoetus nigricans Günther, Fische der Südsee, Heft VIII. 1909, p. 367.
Exocoetus (*nigricans*?) Max Weber, Siboga-Expeditie, Fische, 1913, p. 126.

D. 14—16; A. 9—11; P. 1.13—14; V. 6; L.l. 45—50; L. tr. $\frac{6}{1}$.
$\frac{}{3}$

Somewhat compressed, the breadth of the body going about 1.2 in its height. Height 6—7, nearly 8—8.5 in length with caudal. Head 4.3—4.6, about 6 in length with caudal. Eye about 3, less than postorbital part of head, which is equal to concave interorbital space and a little less than or equal to snout. Teeth well developed, conical, pointed, in several rows in the jaws and in a small oblong patch on each side on the palatines (absent on the palatines according to BLEEKER). Origin of anal opposite to 6th or 7th dorsal ray. Origin of dorsal separated by 27—28 scales from occiput. Pectorals quite or nearly reaching base of caudal. Ventrals much longer than head, reaching to middle of anal or farther, their origin about midway between hindborder of praeoperculum and base of caudal.

Caudal deeply forked. Colour of preserved specimens brownish above, silvery or golden below. Pectorals black, with an oblique hyaline band which tapers backwards and is more developed in young specimens than in older ones. Distal half of ventrals and posterior half of dorsal black. Anal white. Caudal darkish. Length about 260 mm.

Habitat: Malacca-straits!, Java-sea!, Bay of Batjan!. — Indic, Pacific and Atlantic, not very common.

5. Cypsilurus altipennis (C. V.)

Exocoetus altipennis Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 109.
Exocoetus speculiger? Bleeker, Nat. Tijdschr. Ned. Indië IX. 1855, p. 273.
Exocoetus katoptron Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 115. — Atl. ichth. VI. 1866—1872, p. 72.
Exocoetus katoptron Günther, Cat. Brit. Mus. VI. 1866, p. 289.
Exocoetus robustus Günther, l.c. p. 289.
Exocoetus altipinnis Day, Proc. Zool. Soc. London, 1888, p. 265. — Fish. Brit. India, 4°. 1878—88, p. 807.
Cypsilurus katoptron Jordan & Seale, Bull. Bur. Fish. XXV. 1906, p. 211.
Cypsilurus altipinnis Seale & Bean, Proc. U. S. Nat. Mus. Wash. XXXIII. 1908, p. 240.
Exocoetus katoptron Günther, Fische der Südsee, Heft VIII. 1909, p. 367.
Cypselurus katoptron Mc Culloch, Rec. Western Austr. Mus. 1 (2) 1912, p. 84.

D. 13; A. 10—12; P. 1.13—15; V. 6; L.l. 46—52; L. tr. $\frac{7}{1}$.
$\frac{}{2}$

Somewhat compressed, the breadth of the body going about 1.4 in its length. Height 5.8, 7.5 in length with caudal. Head 4.2, 5.4 in length with caudal. Eye 2.7—3, somewhat less than postorbital part of head and about equal to slightly concave interorbital space. Snout 1.2—1.7 in eye. Teeth very small, scarcely conspicuous, in narrow bands in the jaws and according to BLEEKER in slender elongate patches on the palatines, but not to be found in the specimens examined by us. Origin of anal opposite to 6th dorsal ray. Origin of dorsal separated by about 28 scales from occiput. Pectorals reaching almost or quite to end of dorsal. Ventrals much longer than head, reaching to middle of anal or farther, their origin not much nearer to base of caudal than to hindmargin of eye. Caudal deeply forked. Colour of preserved specimens brownish above, silvery below. Fins more or less dusky. Pectorals blackish; with an oblique hyaline band and a hyaline hindermargin. Length 400 mm.

Habitat: Sumatra (Siboga); Java Sea!. — Philippines; Samoa; Australia; Bombay; Red Sea!.

6. Cypsilurus hexazona (Blkr.)

Exocoetus hexazona Bleeker, Nat. Tijdschr. Ned. Indië IV. 1853, p. 206. — Ned. Tijdschr. Dierk. III. 1866, p. 118. — Atl. ichth. VI. 1866—1872, p. 73.

D. 10—11; A. 9—10; P. 1.13; V. 6; L.l. circa 48.

Height about $4^3/_4$, about 6 in length with caudal. Head about 4, somewhat more than 5 in length with caudal. Eye about 2, $^2/_3$ in postorbital part of head and about equal to interorbital space. Teeth minute. Palate edentulous. Origin of dorsal far before that of anal and much longer than lastnamed fin. Pectorals reaching to posterior part of dorsal. Ventrals much longer than head, nearly reaching to base of caudal, their origin a little nearer to branchial opening than to base of caudal. Caudal deeply forked. Bluish green above, silvery below. Six brown crossbands on the body; the first through the eye, 2nd dorso-pectoral, 3rd and 4th dorso-ventral, 5th and 6th dorso-anal. Vertical fins hyaline, dorsal with a broad brown margin, anal and lower caudal lobe brown at their tip; pectorals and ventrals brownish or blackish violet, pectorals with a transverse hyaline band in their middle. Length of single specimen known 54 mm. [After BLEEKER, not seen by us].

Habitat: Banka.

This is the young stage of some species close to *C. altipennis* and *nigricans*, from which it seems to differ in the low number of dorsal rays.

7. Cypsilurus bilobatus n. sp.

Exocoetus furcatus M. Weber, in Semon, Zool. Forschungsreise, V. 1895, p. 274 (Jenaische Denkschr. III. 1895, p. 114 (nec MITCHELL).

D. 13; A. 9—11; P. 1.12; V. 6; L.l. circa 50; L. tr. $\frac{9}{\frac{1}{2}}$.

Compressed, the breadth of the body going 1.7 in its height. Height 5, more than 6 in length with caudal. Head 4, more than 5 in length with caudal. Eye 2.7, less than postorbital part of head, which is equal to flat interorbital space. Snout 1.4 in eye. Teeth conical, pointed, in one or two rows in the jaws and in a small patch on each side on the palatines. At each side of corner of mouth the lower lip has a broad, ribbon-like barbel, which is somewhat longer than half length of head. Origin of anal opposite to 5th dorsal ray. Origin of dorsal separated by 32 scales from occiput. Pectorals reaching to poste-

rior half of dorsal. Ventrals much longer than head, reaching to posterior half of anal, their origin midway between hindmargin of eye and base of caudal. Caudal deeply forked. Brownish above, silvery below. Pectorals with rows of oblong spots, more or less arranged in transverse rows. Ventrals with black tips. Barbels black. Length of single specimen known 128 mm.

Habitat: South coast of New Guinea!

This species is closely allied to *E. furcatus*, from which it differs by having the pectorals spotted and one or two rays more in the anal.

8. Cypsilurus poecilopterus (C. V.) [Fig. 63, p. 179].

Exocoetus poecilopterus Cuvier & Valenciennes, Hist. nat. Poiss. XIX. 1846, p. 112.
Exocoetus poecilopterus Günther, Cat. Brit. Mus. VI. 1866, p. 291.
Cypsilurus poecilopterus Jordan & Starks, Proc. U. S. Nat. Mus. XXVI. 1903, p. 542.
Cypsilurus poecilopterus Jordan & Seale, Bull. Bur. Fish. Wash. XXV. 1906, p. 210.
Exocoetus poecilopterus Günther, Fische der Südsee, Heft VIII. 1909, p. 368.
Cypselurus poecilopterus Snyder, Proc. U. S. Nat. Mus. Wash. vol. 42, 1912, p. 409.

D. 12; A. 7—8; P. 1.14—15; V. 6; L. l. 45; L.tr. $\frac{8}{1}$.

Compressed, the breadth of the body going about 1.5 in its height. Height 4.6 to nearly 5. Head about 4, about 5.3 in length with caudal. Eye 2.8—3, somewhat less than the postorbital part of head, which is equal to the almost flat interorbital space. Snout somewhat shorter than eye. Teeth tricuspid, in bands of several rows in the jaws and in an elongate patch on each side on the palatines. Origin of anal opposite to 6th dorsal ray. Origin of dorsal separated by 25—27 scales from occiput, its distance from first rudimentary rays of caudal much more than length of head. Pectorals extending to the end of the dorsal or farther. Ventrals much longer than head, almost reaching to end of anal, their origin midway between base of caudal and hindmargin of eye or of praeoperculum. Caudal deeply forked. Colour of preserved specimens brownish above, silvery below. Pectorals with numerous rather large, ovate, black spots, distinctly arranged in transverse bands, but absent in lower part of the fin. Other fins hyaline, caudal dusky. Dorsal and ventrals sometimes with a black patch. Length 250 mm.

Habitat: Flores!; Banda. — New Britain, Samoa, Japan.

Note. The fish described by DAY (Fish. India 4°, 1878—1888, p. 518) as *E. poecilopterus* seems to be *C. spilopterus* (C.V.) a species with smaller scales.

9. Cypsilurus atrisignis Jenk.

Cypsilurus atrisignis Jenkins, Bull. U. S. Fish Comm. XXII. (1902) 1904, p. 436.
Cypsilurus atrisignis Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 136.
Exocoetus atrisignis Günther, Fische d. Südsee, Heft VIII. 1909, p. 368.

D. 13—15; A. 10; P. 1.13; V. 6; L.l. 56—62; L.tr. $\frac{8-9}{1}$.
$\frac{}{3}$

Somewhat compressed, the breadth of the body going about 1.3 in its height. Height somewhat more than 5—5.5, 6.5 in length with caudal. Head 4.3, about 5.5 in length with caudal. Eye 3, somewhat less than postorbital part of head, which is equal to the somewhat concave interorbital space. Snout somewhat shorter than eye. Teeth comparatively well developed, slender, simple, in two rows in the jaws and in a small patch on each side on the palatines. Origin of anal opposite to 6th dorsal ray. Origin of dorsal separated by about 40 scales from occiput, its distance from first rudimentary rays of caudal longer than head. Pectorals reaching to end of dorsal. Ventrals reaching almost to middle of anal, much longer than head, their origin midway between hindmargin of eye and base of caudal. Caudal deeply forked. Colour of preserved specimens brownish above, golden below. Pectorals dusky, with round and oblong spots, more or less arranged in rows. Ventrals and anal hyaline, dorsal with a large black spot in its posterior half, which may be wanting. Caudal dusky. Length 340 mm.

Habitat: Malacca straits!. — Hawaii; Strong Island; Greenwich Island.

10. Cysilurus spilopterus (C. V.)

Exocoetus spilopterus Cuvier & Valenciennes, Hist. nat. Poissons XIX. 1846, p. 113.
Exocoetus spilopterus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 116; — Atl. ichth. VI. 1866—1872, p. 74.
Exocoetus spilopterus Günther, Cat. Brit. Mus. VI. 1866, p. 292. — Fische der Südsee Heft VIII. 1909, p. 368.
Exocoetus poecilopterus Day, Fishes of India 4°, 1878—1888, p. 518 (nec C.V.).
Exocoetus spilopterus Max Weber, Siboga-Expeditie, Fische 1913, p. 126.

D. 12—13; A. 10; P. 1.13—14; V. 6; L.l. 50—55; L.tr. $\frac{7\frac{1}{2}}{1}$.
$\frac{}{3}$

Compressed, the breadth of the body going 1.4—1.5 in its height. Height 5—5.3, 6.5—7 in length with caudal. Head 4—4.3, 5—5.5 in length with caudal. Eye 2.6 to nearly 3 in head, scarcely less than postorbital part of head, which is equal to interorbital space. Snout about $^3/_4$ of eye. Teeth comparatively well developed, simple, in a few rows in the jaws; a few teeth on each side on the palatines. Origin of anal opposite to 6th ray of dorsal. Origin of dorsal separated by about 30 scales from occiput, its distance from first rudimentary rays of caudal equal to head or only scarcely longer than head. Pectorals reaching to posterior part of dorsal or farther. Ventrals longer than head or scarcely so, reaching to middle of anal or not so far, their origin about midway between base of caudal and hindmargin of praeoperculum. Caudal deeply forked. Pectorals blackish, with a narrow hyaline hindborder and an indication of a hyaline transverse band and provided with more or less numerous round black spots. Other fins hyaline, caudal dusky. Ventrals and dorsal sometimes with a black spot posteriorly. Length 350 mm.

Habitat: Pulu Weh!; Java Sea!; Celebes (Menado, Gorontalo!); between Buton and Buru!. — Seas of India, Tahiti.

11. **Cypsilurus naresi** (Gthr.)

Exocoetus naresii Günther, Zool. Challenger Exp. XXXI. pt. LXXVIII. 1889, Pelagic Fish, p. 36. — Fische der Südsee, Heft VIII. 1909, p. 365.
Cypsilurus naresi Jordan & Seale, Bull. Bur. Fish. XXV. 1906, p. 211.
Exocoetus Naresii M. Weber, Siboga-Expeditie, Fische, 1913, p. 128.

D. 10—12; A. 8—9; P. 1.13—14; V. 6; L.l. 45.

Height somewhat more than 5, $6^1/_2$—7 in length with caudal. Head 4 or nearly 4, 5 or a little more than 5 in length with caudal. Eye 3, somewhat more or less than postorbital part of head and equal to or somewhat less than flat interorbital space. Snout shorter than eye. Teeth minute, apparently absent from palate. A broad ribbon-like barbel at symphysis of lower jaw, consisting of a white median ridge which bears a deep black lamella at each side and reaches somewhat farther than the base of pectorals or almost to the ventrals. Origin of anal about opposite to 4th—6th dorsal ray. Origin of dorsal separated by 27—32 scales from occiput. Length of anal $^2/_3$ of that of dorsal or a little longer. Pectorals reaching to end of dorsal or not so far. Ventrals much longer than head, reaching to

caudal or not so far; their origin about in the middle between head and base of caudal. Caudal deeply forked. Colour of preserved specimens brownish, silvery below. Pectorals black in their superior part or black with the upper and lower margin white. Ventrals black with exception of the middle fourth or black with the inner border white. Lower tip of caudal sometimes, last third of anal always black. Dorsal dusky. Length of the three known specimens 60, 150 and 175 mm.

Habitat: Between Gébé and Fau![1]) — Between the Fidji and New Hebrides Islands.

12. Cypsilurus oligolepis (Blkr.)

? *Exocoetus commersonii* Lacépède, Hist. nat. Poissons V. 1803, p. 402.
? *Exocoetus exiliens* Lacépède, ibid. (nec. Bl.).
? *Exocoetus Commersonii* Cuvier & Valenciennes, Hist. Nat. Poissons XIX. 1846, p. 102.
Exocoetus unicolor? Bleeker, Verh. Bat. Gen. XXIV. 1852, Snoekacht. Visschen, p. 21 (nec C. V.).
Exocoetus oligolepis Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 109. — Atl. ichth. 1866—1872, p. 69.
Exocoetus brachysoma Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 111. — Atl. ichth. VI. 1866—1872, p. 70. — Poissons de Madagascar 1875, p. 101.
Exocoetus neglectus Bleeker, Ned. Tijdschr. Dierk. III. 1866, 112. — Atl. ichth. VI. 1866—1872, p. 71.
Exocoetus oligolepis Günther, Cat. Brit. Mus. VI. 1866, p. 296. — Fische d. Südsee Heft VIII. 1909, p. 370.
Cypsilurus, brachysomus Jordan & Seale, Bull. Bur. Fish. Wash. XXVI. (1906) 1907, p. 9.
Exocoetus brachysoma M. Weber, Siboga-Expeditie, Fische, 1913, p. 125.

D. 12—13; A. 8—9; P. 1.13—14; V. 6; L. l. 42—45; L. tr. [2]) $\frac{7}{1\frac{1}{2}}$.

Rather compressed, the breadth of the body going about 1.5 in its height. Height 4.7—5.5, 5.8—7 in length with caudal. Head about 4, 5—5.5 in length with caudal. Eye about 2.5 in head, scarcely less than postorbital part of head, about twice as long as snout and a little less than the somewhat concave interorbital space. No chinbarbel. In the jaws bands of 2 or 3 rows of small tricuspid teeth; on the palatines an elongate spindleshaped patch of teeth on each side. Origin of anal opposite to 6th or 7th dorsal ray. Origin of dorsal separated by 23—28

1) The specimen of 150 mm., belonging to the fishery laboratory at Batavia, without definite locality, is certainly from the Archipelago.

2) Between D. and A.

scales from occiput. Pectorals reaching to origin of anal or farther. Ventrals much longer than head, extending at least to the middle of the anal, their origin a little nearer to caudal than to hindmargin of eye. Caudal deeply forked. Colour of preserved specimens brownish above, silvery below. Fins hyaline, pectorals blackish in their upper half. Length 260 mm.

Nom. indig.: Ikan terbang (Malay. Batavia), Luwin-luwin (Ambon), Antori biru (Batjan).

Habitat: Singapore; Sumatra (Padang, Priaman); Java-sea!; Java (Batavia!); Borneo (Sarawak); Bali; Flores!; Celebes (Makassar); Batjan; Obi!; Ambon; Banda. — Philippines, Solomons, Shortland Island, Tahiti, Muscat, Zanzibar, Bourbon, China.

Note. We have examined specimens of *E. oligolepis*, *brachysoma* and *neglectus* of BLEEKER's collection in the Leiden Museum. We can't find any difference between specimens of the two first named species, while the specimen of *E. neglectus* is a little more elongate and has 28 rows of scales between occiput and dorsal, while the others have only 22 or 23. One of us [l.s.c.] has already mentioned a specimen from Obi, which has the measurements of *brachysoma* but the high number of scales between occiput and dorsal of *neglectus*. The differences between *E. negléctus* and the other two species are thus bridged over. There is no difference in the number of dorsal rays between the three species of BLEEKER, as mentioned by the author.

13. Cypsilurus bahiensis (Ranz.)

Exocoetus bahiensis Ranzani, Nov. Comm. Acad. Sci. Inst. Bonon. V. 1842, p. 362.
Exocoetus spilonotopterus Bleeker, Ned. Tijdschr. Dierk. III. 1866, p. 113.
Exocoetus bahiensis Günther, Cat. Brit. Mus. VI. 1866, p. 293.
Exocoetus bahiensis Bleeker, Atl. ichth. VI. 1866—1872, p. 71.
Exocoetus bahiensis Day, Fishes of India 4°, 1878—1888, p. 518.
? *Cypsilurus bahiensis* Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 136.
Cypselurus spilonopterus Jordan & Richardson, Bull. U. S. Fish Comm. XXVII. (1907) 1908, p. 243.
Cypsilurus spilonotopterus Jordan & Dickerson, Proc. U. S. Nat. Mus. Wash. XXXIV. 1908, p. 606.
Exocoetus bahiensis Günther, Fische der Südsee, Heft VIII. 1909, p. 369.
Cypsilurus bahiensis Kendall & Goldsborough, Mem. Mus. Compar. Zoology Harvard Coll. XXVI. No. 7, 1911. p. 253.

$$\frac{8}{2\frac{1}{2}}$$

D. 13; A. 10—11; P. 1.13; V. 6; L.l. 48; L.tr. 1.

Somewhat compressed, the breadth of the body going 1.4 in its height. Height about 5, 6.6 in length with caudal. Head 4.1—4.3, 5.3—5.8 in length with caudal. Eye 3, 1.3 in postorbital part of head and somewhat less than slightly concave interorbital space. Snout somewhat less than eye. No chin-barbel. Teeth comparatively large, simple, conical, pointed, in bands of about three rows in the jaws and in a small ovate patch on each side on the palatines. No vomerine teeth. Origin of anal opposite to 5th or 6th dorsal ray. Origin of dorsal separated by about 30 scales from occiput. Pectorals reaching to end of dorsal or farther. Ventrals longer than head, extending to middle of anal, their origin somewhat nearer to caudal than to hindmargin of eye. Caudal deeply forked. Blackish above, silvery below. Pectorals black, narrowly bordered with white below and behind. Hinder two thirds of dorsal with a large black patch. Ventrals and caudal mottled with dusky. Length 475 mm.

Habitat: Pulu Weh!; Sumatra (Padang); Molucco straits!; Misol. — Hawaiian islands; Philippines; Formosa; Shanghai; Indic; Red Sea; Atlantic coast of tropical America.

14. **Cypsilurus opisthopus** (Blkr.)

Exocoetus opisthopus Bleeker, Ned. Tijdschr. Dierk. III, 1866, p. 121. — Atl. Ichth. VI. 1866—1872, p. 76.

Exocoetus opisthopus Günther, Cat. Brit. Mus. VI. 1866, p. 297. — Brenchley's Cruise of the "Curaçoa", 1873, p. 411.

Cypsilurus opisthopus Bean & Weed, Proc. U. S. Nat. Mus. vol. 42, 1912, p. 595.

D. 10—11; A. 9; P. 1.13; V. 6; L. l. 50—55.

Somewhat compressed, the breadth of the body going 1.3 in its height. Height 5—5.3, 6.3—6.7 in length with caudal. Head 4.3, about 5.5 in length with caudal. Eye 3 or nearly so; 1.4 in postorbital part of head and not much less than interorbital space. Teeth tricuspid in both jaws (at least partly), small, in several rows. On each side on the palatines a long narrow patch of teeth. Origin of anal opposite to 5th dorsal ray. Origin of dorsal separated by 28—30 scales from occiput. Pectorals reaching to middle of dorsal fin or a little farther. Ventrals longer than head, reaching to end of anal, their origin nearer to base of caudal than to branchial opening, sometimes even by as much as postorbital part of head. Caudal deeply forked. Colour of preserved specimens brownish above,

silvery below. Pectorals blackish in their upper two thirds, the rest being hyaline, reddish at the axil. Outer ventral rays more or less grayish. Caudal dusky. Length 240 mm.

Habitat: Java (Batavia); Celebes (Makassar); Flores!; Ambon!; Banda!; Misol.

15. **Cypsilurus nigripennis** (C. V.)

Exocoetus nigripennis Cuvier & Valenciennes, Hist. nat. Poissons, XIX. 1846, p. 108.
Exocoetus nigripennis Bleeker, Act. Soc. Scient. Indo-Neerl. II. 1857, 8ste Bijdr. Amboina p. 86. — Ned. Tijdschr. Dierk. III. 1866, p. 120. — Atl. ichth. VI. 1866—1872, p. 70.

D. 11—13; A. 8—10; P. 1.14—15; V. 6; L.l. 45—50.

Somewhat compressed, the breadth of the body going about 1.5 in its height. Height about 5, 6.5 in length with caudal. Head 4.3, 5.4 in length with caudal. Eye a little more than twice in head, somewhat longer than postorbital part of head and about equal to interorbital space, which is concave. Snout very short, less than half diameter of eye. No chinbarbel. Teeth in jaws very small. Palate edentulous. Origin of anal opposite to about the 5th dorsal ray. Pectorals reaching origin of anal. Ventrals much longer than head, reaching to end of anal, their origin about midway between caudal and hindborder of eye. Caudal deeply forked. Colour of preserved specimens brownish, silvery below. Fins blackish, caudal yellowish with indications of an irregular dark crossbar at its base. Length 75 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Singapore; Ambon; Ternate; Gébé, New Guinea. — Pinang, Indian Ocean to Zanzibar and Madagascar.

Note. This species is most probably the young stage of some other species. The species described by CANTOR (Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1233) and GÜNTHER (Cat. Brit. Mus. VI. 1866, p. 298) as *nigripennis* are the young ones of another species, where the anal is opposite to the dorsal (LÜTKEN, Vidensk. Meddel. naturh. Foren. 1876, p. 112).

16. **Cypsilurus brevis** n. sp.

D. 12—13; A. 9; P. 1.14; V. 6; L.l. 49—52; L.tr. $\frac{7\frac{1}{2}}{3}$.

Compressed, the breadth of the body going about 1.7 in

its height. Height 4—4.5, 5.3—6 in length with caudal. Head 3.9—4, 5—5.1 in length with caudal. Eye 3, slightly less than postorbital part of head, which is about equal to interorbital space. Snout somewhat shorter than eye, its upper profile gently sloping downward in a straight line from eye to tip. Teeth minute, conical, in several rows in the jaws; none on the palate. Origin of anal below 6th ray of dorsal. Origin of dorsal separated by 27 scales from occiput, its distance from first rudimentary rays of caudal equal to or a little more than length of head. Ventrals reaching to about middle of anal, longer than head; their origin midway between base of caudal and hindmargin of praeoperculum. Caudal deeply forked. Colour dark above, silvery below. Pectorals dusky in their upper part, hyaline in the lower part, reddish brown at the axil. Dorsal and caudal dusky. Anal and ventrals white, the outer rays of the latter somewhat dusky. Length 256 mm.

Habitat: Saleyer!; Aru Islands!.

Note. This species is allied to *C. bahiensis* and *C. oligolepis*, from both of which it differs through the absence of teeth on the palate. It is moreover distinguished from *C. bahiensis* by its greater height, smaller teeth, less blunt profile of snout, and from *C. oligolepis* by its simple, not tricuspid teeth and smaller scales.

17. **Cypsilurus rondeleti** (C. V.)

Exocoetus Rondeletii Cuvier & Valenciennes, Hist. nat. Poiss. IX. 1846, p. 115.
Exocoetus brachycephalus Günther, Cat. Brit. Mus. VI. 1866, p. 297.
Exocoetus brachycephalus Lütken, Vidensk. Meddel. naturh. Foren. 1876, p. 405, (résumé p. 110).
Exocoetus Rondeletii Vinciguerra, Ann. Mus. Civ. Genova, XVII. 1883, p. 574.
Exocoetus rondeletii Jordan & Evermann, Fishes of North and Middle America, I. 1896, p. 733.

D. 10—12; A. 12—13; P. 2.18; V. 6; L.l. circa 50; L. tr. $\frac{7}{1}$.

Compressed, the breadth of the body going about 1.3 in its height. Height somewhat more than 5, 6.5 in length with caudal. Head 4.5, almost 6 in length with caudal. Eye 3, less than postorbital part of head, which is equal to flat interorbital space. Snout more than half length of eye. Teeth comparatively well developed, simple, conical, in one or two rows in the jaws; none on the palate. Origin of anal opposite to 2nd

dorsal ray, its base not much shorter than that of dorsal. Origin of dorsal separated by about 30 scales from occiput. Pectorals with the two first rays undivided, the first about half as long as the third, the second about two thirds of third ray. Pectorals reaching to base of caudal. Ventrals much longer than head, reaching to end of anal; their origin scarcely nearer to branchial opening than to base of caudal. Caudal deeply forked. Colour of preserved specimens brownish above, silvery below. Pectorals blackish, with a light hindmargin. Ventrals black in the middle, hyaline along the margins. Dorsal and anal hyaline. Caudal dusky. Length 275 mm.

Habitat: Java. — China, tropical and subtropical Atlantic, Mediterranean.

Note. LÜTKEN l.s.c. examined specimens from Java, from which the author says, that they did differ in details from *Exocoetus brachycephalus* Gthr. It is possible that these specimens, the only ones recorded with certainty from the indo-australian Archipelago, belonged to the allied *C. gilberti* Snyder (Bull. U. S. Fish Comm. XXII. 1904, p. 522).

We examined a specimen of *C. rondeleti* (C.V.) in the collection of the Zoological Museum of Amsterdam, without locality, but probably from the indo-australian Archipelago.

Order PERCESOCES.

Airbladder, if present, without open duct. Ventral fins with 1 spine and 5 rays, abdominal, by exception subabdominal or secondarily thoracal. The pelvic bones are free, or attached to the pectoral arch by ligament only. Two dorsal fins, the first, with pungent or flexible spines, is more or less remote from the second. Pectorals more or less elevated, generally about on a level with the upper posterior angle of operculum. Maxillaries excluded from border of mouth. Eyes lateral, with or without gelatinous eyelids. Teeth present or absent, minute, setiform, villiform or large and cutting. Scales generally cycloid or ctenoid, with or without a lateral line. Gillopenings wide, gillmembranes free from isthmus, not connected. Branchiostegals 5—7. Opercles usually unarmed. Lower pharyngeals separate, third and fourth superior pharyngeals on each side separate or anchylosed. No suprabranchial organ. Parietals separated by supraoccipital. Bones of skull generally without muciferous canals.

Key to the indo-australian families of Percesoces.

I. Pectorals placed low down with a lower detached portion of free, articulated filaments, which can be moved independently. Lateral line well developed, continued on tail. Maxillaries without a supplemental bone. Snout obtusely conical, projecting over the wide mouth. Small villiform teeth on jaws, palatines and sometimes on vomer. Gillrakers long and slender . . . . . *Polynemidae* p. 196.

II. Pectorals normal, without detached rays.

1. Lateral line well developed. Maxillaries with a supplemental bone. Mouth very wide. Large fang-like teeth, implanted in sockets. Pectorals below middle of height. Third and fourth upper pharyngeals separate. Gillrakers obsolete . . . . . *Sphyraenidae* p. 218.

2. Lateral line absent or only rudimentary. Maxillaries

without supplemental bone. Mouth moderate or small. Teeth usually small, not implanted in sockets or absent. Pectorals in or above middle of height. Third and fourth upper pharyngeals of each side anchylosed. Gillrakers long and slender (*Mugiloidei* Klunzinger).

a. First dorsal with no more than 4 stiff spines; anal with 3 weak spines. Mouth usually with a rather wide transverse part, the lateral cleft usually short. Superior pharyngeals without teeth, forming together with gillrakers a filtering apparatus. Vertebrae 24—26 . . . . . *Mugilidae* p. 229.

b. First dorsal formed otherwise. Anal with a single weak spine. Cleft of mouth not transverse. Superior pharyngeals bearing teeth, forming no filtering apparatus with gillrakers. Vertebrae more than 30. *Atherinidae* p. 266.

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1. Fam. Polynemidae.

Oblong, compressed, covered with large, feebly ciliated scales. Lateral line continued on the tail. Head scaly, with the snout more or less obtusely conical and projecting over the mouth, which is rather large. Intermaxillaries protractile, bordering the upper jaw. Maxillaries styliform and slightly or strongly widened posteriorly and then reaching far behind eye; a supplemental bone is wanting. Eyes rather large with an anterior and posterior gelatinous eyelid. Small villiform teeth on jaws, palatines and sometimes on vomer. First dorsal with 7—8 feeble spines, remote from second dorsal, which is of equal height but generally longer, consisting of 11—15 rays. The anal is opposite and similar to it or much longer. Caudal fin deeply forked. Second dorsal, anal and caudal more or less covered with minute scales. Ventrals with 1 spine and 5 rays, abdominal but near to pectorals (subabdominal). Pelvic bones not attached to cleithra but firmly connected with the postclavicles. Pectorals placed low down, consisting of two portions, the upper one or main fin attached to the scapula. The lower one consists of free, articulated pectoral filaments, which can be moved independently and are organs of touch; they are attached to a fenestrate bone plate formed by the coalesced pterygials and anchylosed with the scapula and coracoid. Gill-

openings very wide. Gillmembranes separate and free from isthmus. Branchiostegals 7. Gillrakers long and slender. Vertebrae 24. Bones of skull with well developed muciferous canals.

Moderate or large fishes, inhabiting sandy shores of tropical seas and sometimes entering rivers, wanting in the Red Sea. Only few specimens of these valued food-fishes extend into temperate regions, probably with currents of tropical water.

Key to the indo-australian genera of Polynemidae.

1. Lower lip only developed at corner of mouth. Teeth extending to the exterior part of jaws; 3 or 4 free pectoral filaments . . . . . *Eleutheronema* p. 197
2. Lower lip well developed, but not continued to symphysis. Teeth in jaws not extending to the exterior; 5 or more free pectoral filaments . . . . . *Polynemus* p. 200.

1. **Eleutheronema** Bleeker.

(Bleeker, Versl. Akad. Amsterdam XIV. 1862, p. 123).

Elongate, somewhat compressed. Snout prominent. Eyes covered by a gelatinous membrane. Mouth very large. Maxillaries scaly. Lips absent, except for the lower lip near corner of

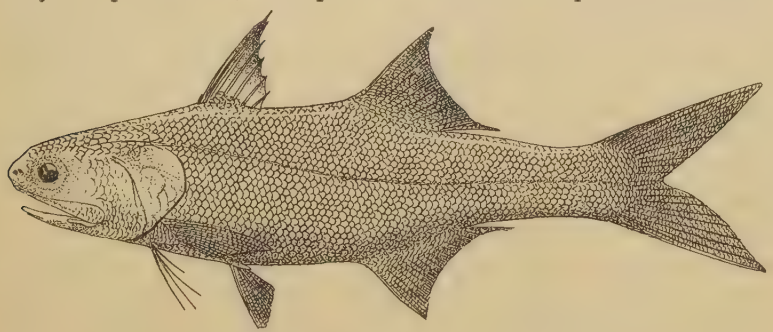

Fig. 64. *Eleutheronema tetradactylum* (Shaw) × 1/3.

mouth. Small teeth which extend to the outside of the jaws. Teeth on vomer, palatines and pterygoids. Praeoperculum serrated behind. Anal of about same length as second dorsal, with 15—17 rays and opposite to it. Pectorals with 3 or 4 free filaments only. Scales small. Gillopenings large, gillmembranes free from isthmus and from each other.

Distribution: From British India to North and West Australia.

Key to the species of Eleutheronema.

1. Three free pectoral filaments . . . . . *E. tridactylum* p. 198.
2. Four free pectoral filaments . . . . . *E. tetradactylum* p. 199.

1. Eleutheronema tridactylum (Blkr.)

Polynemus tridactylus Bleeker, Nat. en Geneesk. Arch. Ned. Indië II. (3) 1845, p. 524. — Verh. Bat. Gen. XXII. 1849, Bijdr. kennis Percoïden, p. 57.
Eleutheronema tridactylum Bleeker, Versl. en Med. Kon. Akad. Amsterdam, XIV. 1862, p. 124.
Polynemus tridactylus Volz, Zool. Jahrb. Abth. Syst. XIX. 1903, p. 359.

D^1. VII; D^2. I. 13; A. I. 15; P. 1.17+3 liberi; V. 1.5; L.l. 70—78; L. tr. $\frac{12}{15}$.

Elongate. Height 4 in length, 5 in length with caudal. Head 3.6, 4.5 in length with caudal. Eyes covered by a gelatinous membrane, 5.3 in head, 1.6 in interorbital space, less than snout, which is very prominent; the mouth beginning at a distance equal to $^3/_4$ of the eye behind the point of the snout. Mouth very large, reaching far behind eye; maxillaries scaly, 1.8 in length of head. Head covered with scales to tip of snout. Anterior and posterior nostrils close together, nearer to end of snout than to eye. Praeoperculum serrated along its hindborder, its angle produced and rounded. Neither upper nor lower lip developed, excepting the lower lip near the angle of the mouth. Upper and lower jaw with a broad villiform band of small teeth, extending on outside of jaws. Similar teeth in a triangular patch on head of vomer and in broad bands on the palatines. Origin of first dorsal between that of pectorals and ventrals. Origin of second dorsal slightly in advance of that of anal, both fins scaly all over. First dorsal with a scaly sheath. Caudal almost entirely covered with scales. First rays of dorsals and anal about equal in length, less than postorbital part of head. Second dorsal and anal deeply concave. Caudal deeply forked. Pectorals falciform, equal to distance between middle of eye and hindborder of operculum. The upper pectoral filament is as long as head without snout, the second one somewhat shorter and the third one much shorter. Ventrals slightly longer than snout and eye. Scales finely striped, with a crenulated hindborder. Colour of alcohol specimen golden, darker above. Fins yellowish, pectorals somewhat darker. Length 354 mm. [A specimen of BLEEKER's collection seen by us].

Nom. indig. Kuru (Malay Batavia); Suro (Pasuruan).

Habitat: Singapore; Sumatra (Banju asin); Java (Batavia, Pasuruan) — Malakka.

In sea and brackish water.

2. **Eleutheronema tetradactylum** (Shaw) [Fig. 64, p. 197].

Polynemus tetradactylus Shaw, General Zoology V. 1804, p. 155.
Polynemus teria Hamilton Buchanan, Ganges Fishes, 1822, p. 224, 381.
Polynemus tetradactylus Cuvier & Valenciennes, Hist. nat. Poissons III. 1829, p. 375, VII. 1831, p. 245.
Polynemus salliah Cantor, Journ. Royal Asiat. Soc. V. 1838, p. 166.
Polynemus quadrifilis Cantor, ibid. p. 166 (nec C. V.).
Polynemus tetradactylus Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdr. kennis Percoïden, p. 57.
Polynemus tetradactylus Cantor, Journ. As. Soc. Bengal XVIII. 1850, p. 1007.
Polynemus tetradactylus Günther, Cat. Brit. Mus. II. 1860, p. 329.
Eleutheronema tetradactylum Bleeker, Versl. & Med. Kon. Akad. Amsterdam, XIV. 1862, p. 124.
Polynemus tetradactylus Kner, Fische Novara-Exp. 1865—1867, p. 138.
Polynemus caecus Macleay, Proc. Linn. Soc. N. S. Wales II. 1878, p. 354.
Polynemus tetradactylus Klunzinger, Sitzber. Akad. Wien 1880, p. 373.
Polynemus tetradactylus Day, Fishes of India 4°, 1878—1888, p. 180.
Polynemus tetradactylus Vinciguerra, Ann. Mus. Civ. Genova (2) IX. 1889—1890, p. 169.
Polynemus tetradactylus Rutter, Proc. Acad. Nat. Sci. Philadelphia 1897, p. 71.
Polydactylus rhadinus Jordan & Evermann, Proc. U. S. Nat. Mus. XXV. 1902, p. 351.
Polydactylus tetradactylus Jordan & Richardson, Bull. Bureau Fish. Washington XXVII. (1907) 1908, p. 245.
Polynemus tetradactylus Seale, Philippine Journ. Sci. V. No. 4, 1910, p. 269.
Polydactylus (Eleutheronema) tetradactylus McCulloch, Rec. W. Austr. Mus. Vol. I. 1913, p. 214.

D^1. VIII; D^2. I—II 13—15; A. II 15—17; P. 16—17 + 4 liberi; V. 1.5; L.l. 78—80; L.tr. $\frac{9—10}{1}$ $\frac{}{13—14}$.

Elongate. Height 3.6—4, 4.5—5.1 in length with caudal. Head 3.3—3.9, 4.3—5 in length with caudal. Eyes covered by a gelatinous membrane, 5.3—5.6 in head, 1.1—1.3 in interorbital space. Snout 1.2—1.5 in eye, prominent. Mouth very large, reaching far behind eye. Maxillaries scaly, 1.7—1.8 in head. Head covered with scales to tip of snout. Anterior and posterior nostrils close together, nearer to point of snout than to eye. Praeoperculum serrated, its angle produced and rounded. Upper lip absent, the lower lip only well developed near angle of mouth. Upper and lower jaw with a broad villiform band

of small teeth, extending to outside of jaws. Similar teeth in a triangular patch on head of vomer and in broad bands on the palatines and pterygoids. Origin of first dorsal between those of pectorals and ventrals. First dorsal spine very small, the second one somewhat less than postorbital part of head. Origin of second dorsal opposite to that of anal. Second dorsal, anal and caudal almost entirely scaly, first dorsal only in its basal part. Second dorsal and anal deeply concave. Distance between origin of ventrals and that of anal much less than length of head. Caudal deeply forked. Pectorals falciform, equal to postorbital part of head or somewhat longer. Upper pectoral filament about as long as the pectoral fin or somewhat shorter, reaching on ventrals, the following ones decreasing gradually in length, the fourth being somewhat more than half the length of the upper one. Ventrals as long as distance from eye to hindborder of praeoperculum. Scales finely striped and with fine denticulations at their hindborder. Colour of alcohol specimens silvery, light brown above. Fins yellowish white, pectoral sometimes dusky, with a smaller or broader blackish hindborder. Length 2000 mm.

Nom. indig.: Selangin and Serangin (Bagan api api); Kuru (Malay Batavia); Lalaut (Bantam); Baling; Kesumbang (Javanese); Latjeh (Madura); Tikus tikus (Ambon); Umpua (Batjan); Kurau putih (Bintang).

Habitat: Singapore; Sumatra (Deli!, Palembang, Bagan api api!, Tiku); Riouw; Banka; Bintang; Borneo (Pamangkat, Sinkawang, Sumpit, Sungi-duri, Stagen!, Balikpapan!, Sandakan); Java (Batavia!, Cheribon!, Antjol!); Madura; Celebes (Makassar!, Lagusi, Menado); Batjan. — From British India, Andamans, Pinang, Siam, Malacca, China, Formosa, Philippines to North and West Australia.

In sea and brackish water.

2. **Polynemus** Linné [1]).

(Linné, Systema Naturae Ed. X. 1758, p. 317).

Polydactylus auctores.

More or less elongate, somewhat compressed. Snout prominent. Eyes covered by a gelatinous membrane. Maxillaries gene-

1) See D. Starr Jordan, The Genera of Fishes. Part I. Leland Stanford Junior Univers. Publications Univ. Series 1917, p. 15.

rally scaly. Upper lip absent, lower lip well developed but not continuous at symphysis. Jaws with villiform bands of teeth, not extending to outside of jaws. Teeth on palatines, on vomer present or absent. Praeoperculum more or less conspicuously serrated behind. Anal of about same length as second

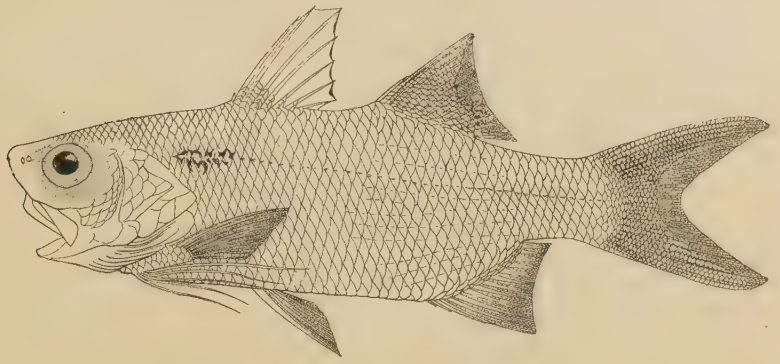

Fig. 65. *Polynemus microstoma* Blkr. × 3/5.

dorsal, its origin opposite to or behind that of second dorsal. Pectorals with 5—14 free filaments. Scales moderate or small. Gillopenings large, gillmembranes free from isthmus and from each other.

Distribution: Tropical coasts of Indic, Pacific and Atlantic.

Key to the indo-australian species of Polynemus

1. Five free pectoral filaments.
   - *A.* Pectoral rays undivided. L.l. 60—65. Distance between origin of ventrals and that of anal much less than length of head. Teeth on vomer . . *P. plebejus* p. 202.
   - *B.* Only 2 or 3 rays of pectorals simple, the other ones divided.
     - *a.* L.l. 47—50. Distance between origin of ventrals and that of anal much less than length of head. No teeth on vomer. . . . . *P. microstoma* p. 204.
     - *b.* L.l. 70—75. Distance between origin of ventrals and that of anal equal to or more than length of head. Teeth on vomer . . . . . *P. indicus* p. 205.
2. Six free pectoral filaments.
   - *A.* Pectoral rays undivided. Teeth on vomer.
     - *a.* L.l. 47—50. Pectoral filaments reaching on anal or farther.
       - *α.* Pectorals longer than head. Longest pec-

toral filaments reaching almost or quite to base of caudal . . . . . *P. hexanemus* p. 207.

β. Pectorals as long as head without snout. Longest pectoral filaments reaching on anal. *P. pfeifferi* p. 208.

b. L.l. 62—68. Pectoral filaments not reaching on anal. . . . . *P. kuru* p. 209.

B. Pectoral rays mostly divided. No teeth on vomer. *P. sextarius* p. 210.

3. Seven free pectoral filaments.

A. Pectoral filaments not exceeding tip of caudal.

a. Pectorals much longer than head, their filaments reaching on the caudal . . . . . *P. melanochir* p. 211.

b. Pectorals shorter than head, their filaments reaching to end of ventrals or somewhat farther . . . . . *P. heptadactylus* p. 212.

B. Pectoral filaments far exceeding tip of caudal.

a. Pectorals longer than head. Eyes small, 5.5 to 7 or more in head.

α. L.l. 84. Distance between origin of ventrals and anal more than length of head. *P. longipectoralis* p. 213.

β. L.l. 65—67.

a'. Distance between origin of ventrals and anal much more than length of head. Maxillaries 1.7—2 in head . . . . . *P. borneensis* p. 214.

b'. Distance between origin of ventrals and anal equal to length of head. Maxillaries 2.2 in head . . . . . *P. dubius* p. 215.

b. Pectorals as long as head without snout. Eyes large, 4.5—6 in head. L.l. 88—93. Distance between origin of ventrals and anal less than length of head . . . . . *P. macrophthalmus* p. 216.

4. Fourteen pectoral filaments . . . . . *P. multifilis* p. 217.

Doubtful species . . . . . *P. paradiseus* p. 218.

1. Polynemus plebejus Brouss.

Polynemus plebejus Broussonet, Ichth. Decas. 1782.

Polynemus lineatus Lacépède, Hist. Nat. Poissons V. 1803, p. 410.

? *Polynemus plebejus* Cuvier & Valenciennes, Hist. nat. Poissons III. 1829, p. 380 (partim?).

Polynemus plebejus Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdr. Percoïden, p. 58.

Polynemus lineatus Günther, Cat. Brit. Mus. II. 1860, p. 327 (nec M'Clelland).

Polynemus taeniatus Günther, ibid. p. 526 (nomen novum).

Trichidion plebejus Bleeker, Versl. Akad. Amsterdam XIV. 1862, p. 110.

Polynemus lineatus Kner, Novara Exp. Fische, 1865—1867, p. 137.

Polynemus plebejus Günther, Fische der Südsee, Bd. 2, 1873—1875, p. 103.

Polynemus plebejus Day, Fishes of India 4°, 1878—1888, p. 179.
Polynemus plebejus Steindachner, Ann. Hofmuseum Wien XI. 1896, p. 208.
Polydactylus plebeius Jordan & Seale, Bull. Bureau Fisheries XXV. (1905) 1906, p. 219.
Polydactylus agonasi Jordan & Mc Gregor, Proc. U. S. Nat. Mus. XXX. 1906, p. 814.
Polydactylus plebeius Seale, Occas. Pap. Bishop Pauahi Mus. IV. 1906, p. 18.
Polydactylus plebejus Steindachner, Sitzb. Akad. Wien, CXV, 1906, p. 1417.
Polydactylus plebeius Seale & Bean, Proc. U. S. Nat. Mus. XXXIII. 1908, p. 241 (salve syn.).
Polynemus taeniatus Gilchrist & Thompson, Ann. South Afric. Mus. VI (part 2), 1908, p. 179.
Polynemus agonasi Franz, Abh. Bayr. Akad. Munchen, IV. Suppl. Band 1. Abh. 1910 (1911), p. 25.
Polynemus plebejus Weber, Siboga Exp. Fische 1913, p. 144.

D^1. VIII; D^2. I. 13; A. II. 11; P. 17—18+5; V. I. 5; L.l. 60—65; L.tr. $\frac{6—7}{1}$.
$\frac{}{12}$

Elongate. Height 3.2—3.3, 4.4—4.5 in length with caudal. Head 3—3.6, 4.2—4.5 in length with caudal. Eyes covered by a gelatinous membrane, 3.5—4 in head, about equal to interorbital space, more than twice in postorbital part of head. Snout short, 1.4—1.7 in eye, prominent, the mouth beginning at a distance equal to $^3/_4$ diameter of eye behind point of snout. Mouth large, reaching far behind eye. Maxillaries scaly, 2—2.3 in head. Head covered with scales to tip of snout. Anterior and posterior nostrils close together, midway between end of snout and eye. Praeoperculum coarsely serrated along its hindborder, its angle produced and rounded. Upper lip absent, lower lip well developed but not continuous at symphysis. Upper and lower jaw with a narrow villiform band of small teeth, not extending on outside of jaws. Broader similar bands on palatines and a patch of teeth on head of vomer. Origin of first dorsal between that of pectorals and ventrals. First dorsal spine very small, second one the strongest, but shorter than the following ones and slightly shorter or longer than postorbital part of head. Origin of second dorsal conspicuously in advance of that of anal, its spine shorter than second spine of first dorsal, but longer than that of anal. First anal spine minute. Second dorsal and anal deeply concave. Dorsals, anal and caudal scaly. Caudal deeply forked, the lobes pointed, the upper one the longer. Pectorals somewhat falciform, as long as or a little shorter than distance between middle of eye and hindborder of operculum. All rays simple. The pec-

toral filaments, the upper one of which is the longest, reach a little beyond tip of ventrals. Ventrals longer than snout and eye together. Distance between origin of ventrals and anal much less than length of head. Scales finely striated and with a crenulated hindborder. Colour of alcohol specimens silvery or golden, fins yellowish or hyaline, pectorals slightly dusky. Length 260 mm. [A specimen of BLEEKER's collection seen by us].

Nom. indig.: Kuru (Malay); Kesumbang (Javanese); Sambal (Madura); Idung lamak (Batjan).

Habitat: Pulu Weh!; Sumatra (Kota Radjah!, Tiku); Nias!; Java (Batavia, Prigi, Penandjong Bay!); Madura; Bali; Celebes (Menado); Ambon; Ceram!; Batjan; Timor; Aru Islands!; New Guinea. — Coast of Natal and Madagascar, Bourbon, Mauritius, British India, Siam, Pinang, Japan, Formosa, Philippines, Australia, New Britain, Solomon-Islands, Samoa, Tahiti, Fiji islands.

In sea and brackish water.

2. **Polynemus microstoma** Blkr. [Fig. 65, p. 201].

? *Polynemus plebejus* Cuvier & Valenciennes, Hist. Nat. Poissons III. 1829, p. 380 (partim?).
Polynemus plebeius Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1009.
Polynemus microstoma Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 217.
Polynemus plebejus Günther, Cat. Brit. Mus. II. 1860, p. 329 (nec Brouss.).
Trichidion microstoma Bleeker, Arch. Néerl. Science Nat. XIII. 1878, p. 64.
Polynemus zophomus Jordan & Mc Gregor, Proc. U. S. Nat. Mus. XXX. 1906, p. 814.
Polydactylus zophomus Jordan & Seale, Bull. Bur. Fish. XXVI. (1906) 1907, p. 11.
Polydactylus zophomus Jordan & Richardson, Bull. Bureau Fish. XXVII. (1907) 1908, p. 245.
Polydactylus zophomus Seale, Philippine Journ. Sci. V. No. 4, 1910, p. 269.
Polynemus zophomus M. Weber, Siboga Exp. Fische 1913, p. 142.

D^1. VIII; D^2. I. 13—14; A. II—III. 12—13; P. 2.13 + 5; V. I.5; L.l. 47—50; L. tr. $\frac{5—6}{1}$ $\frac{}{10—12}$.

Elongate. Height 3—3.2, 4—4.1 in length with caudal. Head 2.8—3, 3.6—4 in length with caudal. Eyes covered by a gelatinous membrane, 3.8—4, equal to interorbital space, and twice in postorbital part of head. Snout shorter than eye, prominent. Mouth large, reaching behind eye. Maxillaries scaly, 2.4 in head. Head covered with scales to tip of snout. Anterior and posterior nostrils close together, midway between end of snout

and eye. Praeoperculum rather coarsely serrated along its hindborder, its angle produced and rounded. Upper lip absent, lower lip well developed but not continuous at symphysis. Small bands of villiform teeth in both jaws, not extending to outside of jaws. Similar bands on the palatines. No teeth on vomer. Origin of first dorsal between that of pectorals and ventrals. First dorsal spine very small, second one the strongest but not as long as the third and more or less longer than postorbital part of head. Origin of second dorsal conspicuously in advance of that of anal. Spine of second dorsal shorter than second one of first dorsal and equal to second anal spine. First anal spine minute. Second dorsal and anal concave. Dorsals, anal and proximal part of caudal scaly. Caudal deeply forked, the lobes pointed. Pectorals somewhat falciform, longer than postorbital part of head, 13 of its rays divided. The upper, longest pectoral filament reaches to middle of ventrals. Ventrals nearly as long as pectorals. Distance between origin of ventrals and anal much less than length of head. Scales finely striated and with a crenulated hindborder. Colour of alcohol specimens golden, brownish above. Fins yellowish, first dorsal and anal more or less dusky, as well as free border of second dorsal. A black blotch in the beginning of the lateral line, above origin of pectorals; a similar blotch sometimes present on operculum. Length 250 mm.

Habitat: North of Strait Riouw!; Borneo (Sandakan); Bali; Sumbawa (Bima!); Saleyer!; Celebes (Bulucomba); Ambon!; Ceram; New Guinea. — Formosa, Philippines, Pinang.

3. **Polynemus indicus** Shaw.

Polynemus indicus Shaw, General Zoology V. 1804, p. 155.
Polynemus sele Hamilton Buchanan, Fishes Ganges, 1822, p. 226 and 381.
Polynemus uronemus Cuvier & Valenciennes, Hist. Nat. Poissons III. 1829, p. 385.
Polynemus uronemus Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdr. Percoïden, p. 58.
Polynemus indicus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1011, (see syn.).
Polynemus indicus Bleeker, Nat. Tijdschr. Ned. Indië VII. 1854, p. 427.
Polynemus indicus Günther, Cat. Brit. Mus. II. 1860, p. 326.
Polynemus indicus Kner, Novara-Exp. Fische, 1865—1867, p. 137.
Trichidion indicum Bleeker, Versl. Akad. Amsterdam (2) II. (1867) 1868, p. 293.
Polynemus indicus Day, Fishes of India 4°, 1878—1888, p. 179.
Polynemus indicus Vinciguerra, Ann. Mus. Civico Genova (2) IX. 1889—1890, p. 168.
Trichidion indicus Fowler, Proc. Acad. Nat. Sc. Philad. (2) LVII. 1905, p. 501.

D^1. VIII; D^2. I. 13—14; A. II—III, 11—12; P. 2—3.12+5; V. 1.5; L.l. 70—75; L.tr. $\frac{7}{1}$ $\frac{}{12—13}$.

Elongate. Height 3.3, 4.6 in length with caudal. Head 3.6, 5 in length with caudal. Eyes covered by a gelatinous membrane, 3.6 in head, about equal to convex interorbital space and about twice in postorbital part of head. Snout pointed, half as long as eye. Mouth large, reaching far behind eye. Maxillaries scaly, twice in head. Head covered with scales to end of snout. Anterior and posterior nostrils close together, about midway between end of snout and eye. Praeoperculum coarsely serrated along its hindborder, its angle produced and rounded. Upper lip absent, lower lip well developed but not continuous at symphysis. Small teeth in narrow bands in the jaws, not extending on outside of jaws. Broader bands of teeth on palatines, constricted in the middle and narrower posteriorly. A rounded patch of similar teeth on vomer. First dorsal spine very small, second one stronger but shorter than third one and equal to postorbital part of head. Second dorsal conspicuously in advance of that of anal, its spine much shorter than second one of first dorsal and about equal to second anal spine, which is as long as snout and eye together. First anal spine minute. Second dorsal and anal deeply concave. Third ray of first dorsal sometimes prolonged into a filament. Dorsals, anal and caudal scaly. Caudal deeply forked, with long, pointed lobes, which may be prolonged into filaments. Pectorals somewhat falciform, as long as distance between middle of eye and hindborder of operculum. Only 2 or 3 rays simple, the other ones divided. Second or third pectoral filament the longest, reaching beyond tip of ventrals or even to anal. Ventrals not much shorter than pectorals. Distance between origin of ventrals and that of anal equal to or more than length of head. Scales finely striated and finely crenulated at their hindborder. Colour of formol specimen light brown, darker above, a darkish blotch shining through on operculum. Faint dark longitudinal lines on body and tail, corresponding to the rows of scales. Fins yellowish, dusky at tips. Length 1000 mm.

Nom. indig.: Kuru (Malay); Kuru-laut (Malay Batavia); Kurau hitam (Bintang).

Habitat: Singapore; Nias!; Banka; Bintang; Borneo (river

Baram); Java (Batavia, Surabaya); Madura; North Celebes; Waigeu. — From Madagascar and Mauritius, British India, Burma, Pinang, Malacca to Australia.

4. Polynemus hexanemus C.V.

Polynemus hexanemus Cuvier & Valenciennes, Hist. Nat. Poissons III. 1829, p. 389.
Polynemus hexanemus Bleeker, Verh. Bat. Gen. XXII. Bijdr. Percoid. 1849, p. 59.
Polynemus hexanemus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1015.
Polynemus hexanemus Günther, Cat. Brit. Mus. II. 1860, p. 325.
Polynemus hexanemus Kner, Novara Exp. Fische 1865—1867, p. 136.

D^1. VIII; D^2.I. 12; A. III. 14; P. 14+6; V. I. 5; L.l. 47—48; L.tr. $\frac{5}{1}$.
$\frac{}{10}$

Height 3.2—4.2 in length with caudal. Head 3.8—4.9 in length with caudal. Eyes nearly 3.8, twice in postorbital part of head and equal to interorbital space. Snout much shorter than eye, prominent. Mouth large, reaching far behind eye. Maxillaries scaly, less than twice in head. Head covered with scales to end of snout. Anterior and posterior nostrils close together, close to frontborder of eye. Praeoperculum rather coarsely serrated, with a broader spine just before the angle, which is rounded and produced. A short spine in the beginning of the lateral line. Upper lip scarcely detectable, lower lip well developed, not continuous at symphysis. A narrow villiform band of teeth in both jaws. A broader similar band on the palatines, more or less constricted in its anterior part and a narrow band of small teeth on head of vomer. Origin of first dorsal between that of pectorals and ventrals. First dorsal spine of first dorsal minute, second one the strongest, but shorter than the third and equal to postorbital part of head. Origin of second dorsal well in advance of that of anal. Spine of second dorsal $^2/_3$ of second spine of first dorsal, longer than third anal spine. First and second anal spine very small. Dorsals, anal and caudal scaly. Caudal deeply forked, the lobes much pointed. Pectorals curved, all the rays simple, longer than head. Pectoral filaments long, the fourth the longest and reaching almost or quite to base of caudal. Ventrals slightly longer than postorbital part of head. Distance between origin of ventrals and anal equal to or shorter than head. Scales finely striated and serrated along their hindborder. Colour of alcohol specimen golden or silvery, brownish above, fins yellowish. Length more than 150 mm. [A specimen of BLEEKER's collection in the Amsterdam Museum seen by us].

Nom. indig.: Kuru (Malay Batavia).

Habitat: Sumatra (Priaman); Borneo (Singkawang); Java (Batavia, Japara). — Pinang.

5. Polynemus pfeifferi Blkr.

? *Polynemus diagrammicus* Bleeker, Nat. & Geneesk. Arch. Ned. Indië II. (3) 1845, p. 527. — Verh. Bat. Gen. XXII. 1849, Bijdr. Percoïden, p. 60.
Polynemus pfeifferi Bleeker, Nat. Tijdschr. Ned. Indië, IV. 1853, p. 249.
Polydactylus pfeifferi Fowler, Proc. Acad. Nat. Sci. Philad. 1900, p. 501.
Polydactylus pfeifferi Fowler, Journ. Ac. N. Sc. Philad. (2) XII, 1904, p. 530, Plate XVI lower figure.

D^1. VIII; D^2. I. 11—12; A. III. 11; P. 12—14 + 6; V. i. 5; L.l. 48—50; L.tr. $\frac{5}{10}$.

Height 3.2, 4.4 in length with caudal, head 3.3, 4.5—5 in length with caudal. Eyes 3—3.3, a little more than flat interorbital space and less than twice in postorbital part of head. Snout short, not much longer than half of eye. Mouth large, reaching behind eye. Maxillaries 1.75—2 in length of head. Head covered with scales to end of snout. Anterior and posterior nostrils close together, close to frontborder of eye. Praeoperculum coarsely serrated, some of the lower denticulations stronger than the rest. Angle of praeoperculum produced and irregularly rounded. Upper lip absent, lower lip well developed but not continuous at the symphysis. Narrow bands of small teeth on jaws, palatines and in an elongate patch on vomer. First dorsal spine minute, second one stronger but shorter than third and equal to postorbital part of head. Spine of second dorsal about equal to third anal spine and to length of eye and snout together. Origin of second dorsal somewhat in advance of that of anal. Free border of dorsals and anal almost straight. Caudal deeply forked, the lobes pointed. Pectorals as long as head without snout, all their rays simple. Longest pectoral filaments reaching well on anal. Ventrals about equal to postorbital part of head. Distance between origin of ventrals and that of anal much less than length of head. Scales finely striated and crenulated at their hindborder. Colour of formol specimens brownish, pectorals and ventrals blackish, other fins dusky. Length 90 mm.

Habitat: Sumatra (Benkulen, Trussan, Padang, Priaman); Nias!. — Sandwich Islands.

Note. The brief description given by BLEEKER of his *Polynemus diagrammicus* gives no clue as to the exact position of this species. It is possibly identical with *P. pfeifferi*, the differences given by BLEEKER in his description of lastnamed species being easily explained by differences of age. The last mention made by BLEEKER of *P. diagrammicus* is in his "Enumeratio piscium" etc. (Act. Soc. Sc. Indo-Neerl. VI. 1859, p. 39). This makes us suppose, that the specimens were lost. They are neither in the British, nor in the Leiden Museum.

In these circumstance we think it safest to place *P. diagrammicus* as a doubtful synonym of *P. pfeifferi*.

6. Polynemus kuru Blkr.

Polynemus kuru Bleeker, Nat. Tijdschr. Ned. Indië IV. 1853, p. 600.
Trichidion kuru Bleeker, Ned. Tijdschr. Dierk. I. 1863, p. 156.
Polydactylus kuru Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard Coll. vol. XXVI. No. 7, 1911, p. 263.
Polynemus kuru Max Weber, Siboga Exp. Fische 1913, p. 141.

D^1. VIII; D^2. I. 13; A. II. 11; P. 15—16+6; V. 1.5; L.l. 62—68; L. tr. $\frac{6}{1}$.
$\frac{}{10}$

Height 3.4—3.5, 4.7—4.8 in length with caudal. Head 3—3.5, 4.3—4.7 in head with caudal. Eyes 3.2—3.7, about twice in postorbital part of head, and somewhat less than convex interorbital space. Snout shorter than eye, prominent. Mouth large, reaching far behind eye. Maxillaries scaleless (in three specimens examined), 2.1—2.3 in head. Head covered with scales to end of snout. Anterior and posterior nostrils close together, about midway between eye and end of snout. Praeoperculum rather strongly serrated, the inferior spines somewhat stronger, its angle produced into a triangular flap. Upper lip absent, lower lip well developed but not continuous at symphysis. Narrow bands of teeth in jaws, palatines and head of vomer, those of the jaws not extending to the outside. Origin of dorsal between that of pectorals and ventrals. First dorsal spine of first dorsal minute, second one shorter than the third, but somewhat stronger, slightly shorter or longer than postorbital part of head. Origin of second dorsal in advance of that of anal. Spine of second dorsal about $^2/_3$ of second spine of first dorsal, longer than second spine of anal. First anal spine minute. Dorsals, anal and caudal scaly. Caudal very deeply forked,

with long pointed lobes. Pectorals curved, all the rays simple, equal to distance between hindborder of operculum and middle of eye. First pectoral filament somewhat longer than the others, surpassing tip of ventrals. Ventrals about equal to postorbital part of head. Distance between origin of anal and ventrals somewhat less than head. Scales finely serrated along their hindborder. Colour of alcohol specimens silvery, somewhat brownish above, fins hyaline, upper part of first dorsal blackish. Length 280 mm.

Nom. indig.: Mulut tikus (Saparua); Suma lahat (Ambon).

Habitat: Sangir Islands!; Talaut; Islands!; Ambon; Saparua; Obi; Ternate; Halmahera; Waigeu; Aru Islands! — Marquesas Islands.

In sea.

7. Polynemus sextarius Bl. Schn.

Polynemus sextarius Bloch, Schneider, Syst. Ichth. 1801, p. 18.
Polynemus sextarius Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdrage Percoïden, p. 59.
Polynemus sextarius Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1014.
Polynemus sextarius Günther, Cat. Brit. Mus. II. 1860, p. 326.
Trichidion sextarius Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 174.
Polynemus sextarius Day, Fishes of India 4°. 1878—1888, p. 177.
Polynemus sextarius Gilchrist & Thompson, Ann. South Afric. Mus. VI. (prt 2), 1908, p. 179.
Trichidion sectarium Jordan & Starks, Ann. Carneg. Mus. XI. 1917, p. 455.

D^1. VIII; D^2. I. 12—13; A. II—III 12—13; P. I. 12—13+6; V. I. 5; L.l. 48—50; L.tr. $\frac{5}{9}$.

Height 2.8—2.9, 3.7—3.8 in length with caudal. Head 2.8—3.3, 3.8—4.4 in length with caudal. Eyes covered by a gelatinous membrane, 3—3.8, twice in postorbital part of head and somewhat more than interorbital space. Snout $^2/_3$ length of eye, prominent. Mouth large, reaching far behind eye. Maxillaries scaly, 2.4 in head. Head covered with scales to tip of snout. Anterior and posterior nostrils close together, midway between eye and point of snout. Praeoperculum coarsely serrated along its hindborder, the lowermost serrations the longest. Its angle produced and rounded. A short, rather strong spine at the beginning of the lateral line. Upper lip feebly developed, lower lip well developed, not continuous at the symphysis. Band of villiform teeth on jaws, not extending to their outside; a similar band on palatines. Vomer without teeth. Origin of first dorsal

between that of ventrals and pectorals. First dorsal spine of first dorsal minute, second one the strongest but not so long as the third, somewhat shorter than snout and eye. Origin of second dorsal well in advance of that of anal. Spine of second dorsal less than half as long as second one of first dorsal and somewhat shorter than second anal spine. First anal spine very small. Dorsals, anal and proximal part of caudal scaly. Caudal deeply forked, the lobes pointed. Pectorals slightly falciform, 12—13 of their rays divided, equal to distance between middle of eye and hindborder of operculum. The two upper free pectoral filaments are about of equal length and longer than the others, they reach to middle of ventrals or somewhat farther. Ventrals $^5/_7$ length of pectorals. Distance between origin of ventrals and anal much less than length of head, somewhat more than postorbital part of head. Scales with a finely striated and crenulated hindborder. Colour of alcohol specimen golden, fins yellowish, more or less dusky. Inner side of operculum pigmented with black, shining through at the outside. A large black blotch at the beginning of the lateral line. Length 190 mm. [Description after a specimen from Calcutta].

Nom. indig.: Kuru (Malay Batavia).

Habitat: Sumatra (Benkulen, Priaman); Banka; Java (Batavia). — From East Coast of Africa (Natal) to British India, Ceylon, Siam, Pinang and China.

In sea.

8. **Polynemus melanochir** C.V.

Polynemus melanochir Cuvier & Valenciennes, Hist. Nat. Poissons VII. 1831, p. 513.
Polynemus melanochir Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdr. Percoïden p. 60.

D^1. VIII; D^2. I. 11—12; A. III. 15; P. 14 + 7; V. I.5; L.l. 51 [1]); L. tr. $\frac{5\frac{1}{2}—6}{1 \over 10}$.

Height 2.9—3, 4.1 in length with caudal. Head 3.4—3.5, 4.5—4.9 in length with caudal. Eyes 3.9—4.1, 2.3—2.6 in postorbital part of head, and scarcely less than the interorbital space. Snout much shorter than eye. Mouth large, reaching far behind eye. Maxillaries scaly, 1.6—1.8 in head. Head covered with scales to end of snout. Nostrils close together, about half way between tip of snout and eye. Praeoperculum

1) 35—40 according to BLEEKER, but this must be a misprint, as we counted 51 in specimens from BLEEKER's collection.

rather coarsely serrated in small specimens, less so in larger ones; the inferior spine more or less longer and coarser than the others. Angle of praeoperculum somewhat rounded and produced. Upper lip absent, lower lip well developed but not continuous at symphysis. Rather narrow bands of teeth in jaws, on vomer and on palatines. Origin of dorsal between that of ventrals and pectorals. First dorsal spine of first dorsal minute, second one thick, stronger but shorter than third, somewhat shorter or longer than postorbital part of head. Origin of second dorsal slightly in advance of that of anal, its spine comparatively strong, $^3/_4$ or somewhat more of second spine of first dorsal. Third anal spine rather strong, $^2/_3$ of that of second dorsal. Caudal deeply forked, the lobes pointed. Pectorals much longer than head, reaching on anal or not so far. Middle pectoral filaments longest, reaching almost to tip of caudal. Ventrals equal to or longer than postorbital part of head. Distance between origin of ventrals and anal conspicuously less than length of head. Colour of alcohol specimens golden, brownish above. Pectorals usually black. Length 170 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Nom. indig.: Kuru (Malay Batavia).

Habitat: Sumatra (Benkulen, Trussan, Padang, Tiku, Priaman, Siboga); Nias; Java (Batavia, Krawang! [Leiden Museum], Palabuan Batu!); Duizend Islands.

9. Polynemus heptadactylus C.V.

Polynemus heptadactylus Cuvier & Valenciennes, Hist. Nat. Poissons, III. 1829, p. 300.
Polynemus heptadactylus Bleeker, Verh. Bat. Gen. XXII. 1849, Bijdrage Percoïden, p. 60.
Polynemus heptadactylus Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1016.
Polynemus heptadactylus Day, Fishes of India 4°. 1878—1888, p. 177.
Trichidion heptadactylum Jordan & Starks, Ann. Carnegie Mus. XI. 1917, p. 455.

D^1. VIII; D^2. I. 11—12; A. III. 11—12; P. 13—15+7; V. I. 5; L.l. 48—50; L.tr. $\frac{5}{1}$.
$\frac{}{10}$

Height 3—3.1, 3.7—4 in length with caudal. Head 3.4—3.7, 4.4—4.5 in length with caudal. Eyes 3.4, about twice in postorbital part of head and equal to the somewhat convex interorbital space. Snout much shorter than eye, prominent. Mouth large, reaching far behind eye. Maxillaries scaly, about twice in head. Head covered with scales to end of snout. Anterior

and posterior nostrils close together, somewhat nearer to end of snout than to eye. Praeoperculum coarsely serrated, its inferior spine more or less distinctly longer and stronger than the others, its angle produced and rounded. Upper lip absent, lower lip well developed but not continuous at symphysis. Narrow bands of small teeth on jaws and on palatines, bands on lastnamed somewhat constricted in the middle. Few teeth on vomer. Origin of dorsal between that of ventrals and pectorals. First dorsal spine of first dorsal minute, second one shorter but stronger than the third and shorter than postorbital part of head. Origin of second dorsal in advance of that of anal, its spine more than $^2/_3$ of second spine of first dorsal and about equal to third anal spine. First anal spine very small. Dorsals, anal and caudal scaly. Caudal deeply forked, the lobes pointed. Pectorals somewhat falciform, all the rays simple, about equal to head without snout. Third, fourth and fifth pectoral filament about of equal length, reaching to end of ventrals or somewhat farther. Ventrals somewhat shorter or longer than postorbital part of head. Distance between origin of ventrals and anal equal to or less than head. Colour of alcohol specimens silvery or golden, brown above. Pectorals blackish, other fins yellowish. Length 150 mm. [Specimens of BLEEKER's collection in Amsterdam Museum seen by us].

Nom. indig.: Kuru (Malay Batavia); Laos (Cheribon); Bulubulu (Badjau); Buluari (Banjermassin).

Habitat: Sumatra (Benkulen, Priaman); Nias; Java (Batavia!, Tandjong Priok!, Cheribon, Samarang); Borneo (Balikpapan!); Moluccos. — Malay Peninsula, Pinang, Ceylon, British India. In sea.

10. Polynemus longipectoralis n. sp.

D^1. VIII; D^2. I. 16; A. II.12; P. 15+7; V. I.5; L.l. 84; L.tr. $\frac{6}{12}$.

Height equal to head, 4 in length, 5.5 in length with caudal. Eyes small, 5.5 in head, 1.3 in convex interorbital space, somewhat less than snout and 3.3 in postorbital part of head. Mouth rather large, reaching somewhat behind eye. Maxillaries scaly, 2.3 in head. Upper jaw not emarginate at symphysis. Anterior and posterior nostrils close together, close to eye. Praeoperculum serrated, rounded and produced at its angle. Narrow bands of small teeth in jaws, an oblong patch of similar

teeth on palatines and a rounded one on vomer. Origin of first dorsal behind that of pectorals and above that of ventrals. Spines of first dorsal soft and flexible, the first one minute, the third one the longest, somewhat produced, and a little shorter than head without snout. Origin of second dorsal well in advance of that of anal, its spine $^5/_7$ of second spine of anal, which is equal to length of maxillary. Dorsals, anal and caudal scaly. Caudal very deeply forked, with elongate pointed lobes. Pectorals pointed, straight, all its rays simple, longer than head by somewhat more than two eye-diameters. The two upper free pectoral filaments exceeding tail by about the length of head and body, third one reaching to end of tail, the fourth reaching to anal, the fifth to end of ventrals, the sixth and seventh not quite so far. Ventrals somewhat more than postorbital part of head. Distance between origin of ventrals and of anal more than length of head. Colour of alcohol specimen yellowish, browner above. Fins yellowish. Length of single specimen 184 mm.

Nomen indig.: Bulu-bulu.

Habitat: Collected by the staff of the Fisheries-steamer "Gier" on the fishmarket of Banjermassin, Borneo.

11. Polynemus borneensis Blkr.

Polynemus macronema Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 419 (nec Pel).
Polynemus borneensis Bleeker, Act. Soc. Sc. Indo-Neerl. II. 1857, 10de Bijdr. Borneo, p. 3.
? *Trichidion hilleri* Fowler, Proc. Acad. Nat. Sc. Philad. (2) LVII. 1905, p. 502.

D^1. VIII; D^2. I. 16; A. III. 12; P. 17+7; V. I.5; L.l. 65—66; L. tr. $\frac{6}{1}$.
$\frac{}{12}$

Height about 4.3, about 6 in length with caudal. Head nearly 4, 5—5.4 in length with caudal. Eye small, 7—9.2, about twice in snout, thrice in interorbital space and about 6 times in postorbital part of head. Mouth large, reaching far behind eye. Maxillaries 1.7—2 in head. Anterior and posterior nostrils close together, near eye. Praeoperculum very feebly serrated, the serrations near the produced and rounded inferior angle of praeoperculum more distinct. Upper lip absent, lower lip well developed but not continuous at symphysis. Bands of small teeth on jaws, not extending to their outside. On each palatine a proximal large pear-shaped patch and a distal smaller

elongate one (this last one may be on pterygoids). No teeth on vomer in specimens examined. First spine of first dorsal minute, second one stronger but shorter than third one and slightly shorter than postorbital part of head. Origin of second dorsal well in advance of that of anal, its spine half as long as second one of first dorsal. Caudal deeply forked, the lobes pointed. Pectorals with all their rays simple, surpassing length of head by three eye-diameters. The two upper pectoral filaments reach far behind tip of caudal, the third reaches on caudal, the fourth on anal, the 5th—7th to end of ventrals or nearly so. Ventrals equal to postorbital part of head. Distance between origin of ventrals and of anal much more than length of head. Colour of alcohol specimens brownish above, yellowish below. Fins dusky, pectorals black. [A specimen of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Sumatra (river Bandju asin and its tributaries); Borneo (Sinkawang, Sampit, Kahajan, Banjermassin, river Baram (*hilleri*)).

Fresh and brackish water.

12. Polynemus dubius Blkr.

Polynemus longifilis Bleeker, Nat. Tijdschr. Ned. Indië I. 1851, p. 268 (nec C.V.).
Polynemus dubius Bleeker, Verh. Bat. Gen. XXV. 1853, Nalez. Ichth. Fauna Bengalen, p. 92.

D^1. VII; D^2. I. 16; A. II.11; P. 17+7; V. I.5; L.l. 67; L.tr. $\frac{5}{15}$.

Height equal to head, 3.9 in length, 5.4 in length with caudal. Eyes small, almost 7 in head, 1.8 in convex interorbital space, 1.5 in snout and 4.4 in postorbital part of head. Mouth large, reaching far behind eye. Maxillaries scaly, 2.2 in head, not emarginate at symphysis. Head covered with scales to end of snout. Anterior and posterior nostrils close together, close to eye. Praeoperculum very feebly serrated, its angle rounded and scarcely produced. Upper lip absent, lower lip well developed but not continuous at symphysis. Bands of small teeth on jaws, not extending to their outside, an oblong patch of similar teeth on palatines and a small patch on vomer. Origin of dorsal between that of pectorals and ventrals. Spines of first dorsal soft and flexible, the first one not minute but almost as long as second, which is the longest, and a little shorter than head without snout. Origin of second

dorsal well in advance of that of anal, its spine weak and somewhat longer than second spine of anal, which is half as long as postorbital part of head. Dorsals, anal and caudal scaly. Caudal very deeply forked, with elongate pointed lobes. Pectorals pointed, straight, all of their rays simple, longer than head by almost 2 eye-diameters. The two upper pectoral filaments exceeding tip of tail by more than length of head and body; third one reaching to end of tail, the fourth and fifth reaching to or on anal; the sixth and seventh to tip of ventrals. Ventrals equal to postorbital part of head. Distance between origin of ventrals and of anal equal to length of head. Colour of formol specimen yellowish, browner above. Fins yellowish. Length 169 mm.

Habitat: Sumatra (Palembang, Bagan api api! Tanah Puteh on river Rokan!); Borneo (Pontianak, Sampit, Banjermassin).

In rivers and sea.

13. Polynemus macrophthalmus Blkr.

Polynemus macrophthalmus Bleeker, Act. Soc. Sci. Ind. Neerl. V. 1858—1859, 7de Bijdr. Sumatra p. 10.

Polynemus borneensis Vaillant, Nouv. Arch. Mus. Hist. Nat. (4) V. 1893, p. 109.

D^1. VIII; D^2. I. 13—14; A. III. 10—11; P. 12—14+7; V. I. 5; L.l. 88—93; L.tr. $\frac{9—11}{1}$ $\frac{}{19—22}$.

Height 3.5—3.8, 4.9—5.1 in length with caudal. Head 3.1—3.5, 4.4—4.7 in length with caudal. Eyes rather large, 4.5—6 in head, about equal to interorbital space and to snout and 2.5—3.3 in postorbital part of head. Mouth large, reaching far behind eye. Maxillaries scaly, with a small triangular knob at symphysis, 2—2.2 in head. Head covered with scales to end of snout. Nostrils close together, about halfway between eye and extremity of snout. Praeoperculum coarsely serrated, its inferior border rounded and somewhat produced. Upper lip absent, lower lip well developed, but not continuous at symphysis. Villiform bands of teeth on jaws, not extending to outside of jaws, a patch of small teeth on vomer and an elongate constricted patch of similar teeth on palatines. Origin of dorsal between that of pectorals and ventrals. Spines of first dorsal rigid, first spine minute, the third one the longest but weaker than the second one, which is the strongest and which is somewhat

shorter than postorbital part of head. Origin of second dorsal well in advance of that of anal, its spine scarcely more than third one of anal and slightly less than snout and eye together. Dorsals, anal and caudal scaly. Caudal deeply forked, with elongate pointed lobes. Pectorals pointed, straight, all of its rays simple; as long as head without snout. Third filament far exceeding tip of caudal, first and second reaching on caudal, fourth reaching on anal, the three lower ones reaching on ventrals. Ventrals equal to or longer than postorbital part of head. Distance between origin of ventrals and that of anal less than length of head. Colour of alcohol specimens silvery, brownish above, fins yellowish, first dorsal and caudal dusky. Length 350 mm.

Habitat: Sumatra (Palembang, river Mussi, Djambi, river Batang Hari!); Borneo (Bunut!, river Kapuas).

In rivers and estuaries.

14. **Polynemus multifilis** Schl.

Polynemus multifilis Schlegel, Fauna Japonica, 1845, p. 29; Bijdragen tot de Dierkunde I. Afl. 4, 1851, p. 11.
Polynemus quaterdecimfilis Pel, Bijdrage Dierkunde I. Afl. 4, 1851, p. 9.
Polynemus polydactylus Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 417.
Trichidion multifilis Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 174.
Polynemus multifilis von Martens, Preuss. Exp. nach Ostasien Zoolog. Bd. I. 1876, p. 309.
Polynemus multifilis Vaillant, Nouv. Arch. Mus. Hist. Nat. (4) V. 1893, p. 108.

D^1. VIII; D^2. I. 14—15; A. II—III. 11—12; P. 14—16 + 14; V. 1.5; L.l. 95—104; L. tr. $\frac{7}{1}\frac{}{}\frac{}{21—23}$.

Height 3.8—4.1, 5.4—6 in length with caudal. Head 4.2—4.4, 6—6.3 in length with caudal. Eyes small 5.8—7.2, 1.3—1.6 in snout, about twice in interorbital space and 3.1—5.2 in postorbital part of head. Mouth large, reaching far behind eye. Maxillaries scaly, 2.2—2.4 in head. Head covered with scales to end of snout. Anterior and posterior nostrils close together, near frontborder of eye. Praeoperculum bluntly denticulated along its hindborder, its angle rounded and produced. Upper lip absent, lower lip well developed but not continuous at symphysis. Narrow villiform bands of teeth on jaws, not extending to the outside, and on palatines, where the bands are constricted in the middle. A small patch of teeth on vomer.

Origin of first dorsal almost above that of ventrals. First spine of first dorsal minute, hidden below the scales. Third spine longest, not weaker than second one and about as long as head. Spine of second dorsal somewhat longer or shorter than snout and eye together and about as long as third or second anal spine. Origin of second dorsal well in advance of that of anal. Dorsals, anal and caudal scaly. Caudal very deeply forked, with long pointed lobes. Pectorals pointed, straight, their rays simple, very long, reaching to anal and exceeding head by half its length. The four upper free filaments much stronger and longer than the other ones, the upper three far exceeding tip of caudal, the fourth one reaching about to tip of caudal, the 5th reaching almost to end of base of anal, the following ones diminishing in length, the fourteenth reaching on ventrals. Ventrals somewhat longer than head without snout. Distance between origin of ventrals and of anal exceeding length of head by more or less than length of eye and snout together. Colour of formol specimens bluish brown above, yellowish white below; the myocommata shining through and giving the appearance of light zic-zac cross bands. Fins yellowish. Length 263 mm.

Habitat: Sumatra (Djambi!); Borneo (Banjermassin, river Kapuas; Sintang, Bunut!). — Siam.

In rivers.

Doubtful species.

Von Martens mentions (Arch. f. Naturgesch. 34. Jahrg. Bd. I. 1868, p. 13) *Polynemus paradiseus* L., a species from the Indian Ocean, with the name of the species between brackets and with a query from Borneo. It is probable, that von Martens' specimen belongs to a related species, as *P. paradiseus* has never been found in the indo-australian Archipelago, although Duncker (Mitth. Naturh. Mus. XXI. 1904, p. 155) mentions it from the Malay Peninsula (fishmarket of Klang).

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2. Fam. Sphyraenidae.

Body much elongate, subcylindrical, covered with small cycloid scales. Lateral line well developed, straight. Head very long, with prolonged snout, scaly on top and on sides. Cleft

of mouth horizontal, wide, bordered by the intermaxillaries which are not protractile, behind which are situated the broad maxillaries, with a supplemental bone. Lower jaw considerably projecting. Teeth large, unequal, fang-like, implanted in sockets, in both jaws and on palatines, none on vomer. First dorsal with 5 strong spines above ventrals, which are before middle of body. Second dorsal far behind first, similar to anal and opposite to it. Caudal forked. Pectorals short, placed rather low. Pelvic bones not connected with the pectoral arch. Third and fourth superior pharyngeals separate as also lower pharyngeals. Gillopenings wide. Gillmembranes not united, free from isthmus. Branchiostegals seven. Gillrakers very short or obsolete. Vertebrae 24.

Carnivorous, very rapacious and active pike-like fishes, often of large size and therefore dreaded by fishermen, living in tropical and subtropical seas, often near mouth of rivers.

By sailors known as Barracuda.

1. **Sphyraena** Bloch, Schneider.

(Bloch, Schneider, Systema Ichthyol. 1801, p. 109).

Body much elongate, somewhat compressed. Snout long, pointed. Mouth large. Strong teeth in both jaws and on palatines, some of them canines. Two dorsals, the first spinous, consisting of 5 rays, the second one with one or two flexible spines in front and 8 or 9 divided rays. The two dorsals at

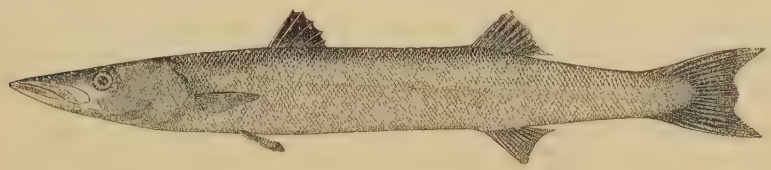

Fig. 66. *Sphyraena jello* C.V. ca $^1/_{10}$.

a considerable distance from each other. Origin of anal opposite to or behind origin of second dorsal. Anal consisting of one or two flexible spines and 7—9 divided rays. Origin of pectorals before that of first dorsal; origin of ventrals before, below or behind origin of first dorsal. Caudal forked. Scales moderate or small. Gillopenings wide. Gillmembranes free from isthmus and from each other.

Distribution: Warm parts of Atlantic, Indic and Pacific, Mediterranean and Red Sea.

Key to the indo-australian species of Sphyraena.

A. Angle of praeoperculum rounded [1]).

I. L.l. 110—130. Teeth in the lower jaw more or less directed backwards.

a. L.l. 123—130. Eye 5.4—8.5, 2.4—3.5 in snout.

1. Origin of first dorsal above tip of pectorals and somewhat behind origin of ventrals . . *S. jello* p. 220.

2. Origin of first dorsal well in advance of tip of pectorals and above origin of ventrals. *S. altipinnis* p. 222.

b. L.l. 110—120. Eye 4.5—4.7, twice in snout. *S. forsteri* p. 223.

II. L. l. 80. Teeth in the lower jaw vertical. . . . . *S. picuda* p. 224.

B. Angle of praeoperculum rectangular.

I. Origin of first dorsal before that of ventrals. L.l. 110. *S. japonica* p. 225.

II. Origin of first dorsal behind origin of ventrals. L.l. 82—87.

a. Origin of first dorsal before vertical through tip of pectorals. Height about 6. Eye 4.3—4.5, not quite twice in snout . . . . . *S. obtusata* p. 226.

b. Origin of first dorsal above or slightly behind vertical through tip of pectorals. Height 6.7—7. Eye 4.9—5. Eye 2.3 in snout . . . . . *S. langsar* p. 228.

c. Origin of first dorsal slightly behind vertical through tip of pectorals. Height about 8. Eye 4.5, twice in snout. . . . . *S. brachygnathus* p. 229.

1. Sphyraena jello C.V. [Fig. 66, p. 219].

Sphyraena jello Cuvier & Valenciennes, Hist. Nat. Poissons III. 1829, p. 349.
Sphyraena jello Bleeker, Verh. Bat. Gen. XXII (1848) 1849, Perc. p. 56; Nat. Tijdschr. Ned. Indië VII. 1854, p. 369; Verh. Bat. Gen. XXVI. 1854—1857, Sphyraen. p. 12.
Sphyraena jello Cantor, Journ. Asiat. Soc. of Bengal, XVIII. 1850, p. 1006.
Sphyraena jello Günther, Cat. Brit. Mus. II. 1860, p. 337.
Sphyraena jello Klunzinger, Abh. zool. bot. Gesellsch. Wien XX. 1870, p. 823; Fische des rothen Meeres I. 1884, 4°, p. 129.
Sphyraena jello Day, Fishes of India 4°, 1878—1888, p. 342.
? *Sphyraena jello* Jordan & Evermann, Proc. U. S. Nat. Mus. XXV. 1902, p. 333.
Sphyraena jello Jordan & Seale, Bull. Bureau Fisheries Washington XXVI. 1906 (1907), p. 11.
Sphyraena jello Evermann & Seale, l. c. p. 59.

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1) As Ogilby does not mention the form of the praeoperculum and the direction of the teeth in the lower jaw in his description of *S. altipinnis*, the position of this species in our key is somewhat arbitrary.

Sphyraena jello Gilchrist & Thompson, Ann. South Afric. Mus. VI. (prt. 2) 1908, p. 195.
Sphyraena jello Max Weber, Siboga-Exp. Fische, 1913, p. 150.

D^1. V; D^2. 2.8; A. 2.8; P. 1.12—13; V. I.5; L. l. 123—130; L. tr. $\frac{17—18}{20—23}$.

Height 6.5—8.7, 8—10 in length with caudal. Head 3—3.5, 3.6—3.9 in length with caudal. Eye 5.4 (spec. of 200 mm. length)—8.5 (spec. of 920 mm. length), 2.4—3.5 (in spec. of 920 mm.) in snout, somewhat more or less than interorbital space, but in large specimens 1.8 in that space, 1.8 (spec. of 200 mm.)—5.7 (spec. of 920 mm.) in postorbital part of head. Maxillary reaching nearly to vertical through frontborder of eye, 2.1—2.4 in head. Angle of praeoperculum rounded. Operculum with two flat flexible spines at the superior part of its hindborder. A single series of compressed teeth and two distant strong canines in the upper jaw. In the lower jaw similar compressed teeth, which are directed backwards, smaller and close together in the anterior part, more distant and caninoid in the posterior part. Besides this a single strong canine at symphysis, bent backwards and fitting into an opening at the tip of the snout. Four to eight compressed canines of different length in a series on each palatine. Mandibles with a fleshy symphysial knob. Origin of first dorsal above tip of pectorals and somewhat behind origin of ventrals. Its three first spines subequal, shorter than postorbital part of head. Base of second dorsal more than twice in its distance from last spine of first dorsal. Second dorsal and anal concave, the rays decreasing in length posteriorly but the last ray besides prolonged. Origin of anal below first half of second dorsal. Pectorals somewhat pointed, about equal to postorbital part of head. Ventrals truncate, shorter than pectorals. Caudal forked, in a large specimen (see figure) the middle caudal rays are somewhat produced, through which this fin is trilobed. Colour of alcohol specimens brownish or grayish above, silvery below, the brown of the back connected with a number of crossbars on the sides of the same colour as the back, which intersect the lateral line and are obsolete in large specimens. Fins more or less dusky or blackish, the ventrals excepted, which are yellowish. Length 1500 mm.

Nom. indig.: Senuk (Malay Batavia) [1]), Langsar (Bantam), Tunel (Samarang), Alu alu (Surabaya), Leres (Pasaruan).

Habitat: Singapore; Sumatra (Padang, Siboga, Telokbetong, Tiku); Nias!; Riouw; Bintang; Banka; Java (Batavia, Bantam, Cheribon!, Samarang, Japara, Surabaya, Pasaruan); Madura!; Bali; Flores!; Solor!; Timor; Borneo (Kota Baru!); Celebes (Makassar!, Bulukomba, Menado!); Saleyer!; Ambon; Ceram (Kawa!); Batjan; Ternate; Mysore. — From coast of Natal, Seychelles, Madagascar, Red Sea, coasts of India, Ceylon, Malay Peninsula, China, Riu Kiu-Islands, Formosa and Philippines.

In sea and brackish water.

2. Sphyraena altipinnis Ogilb.

Sphyraena altipinnis Ogilby, Proc. Roy. Soc. Queensland XXIII. 1910, p. 8.

"D. V—I 9; P. 15; Sc. 13—128—24. Depth of body 7.15, of caudal peduncle 14.4, length of head, 3.2, of caudal fin 4.55, of pectoral 8.75, predorsal length 2.45 in length of body. Length of snout 2.15, diameter of eye 5.15, width of interorbit 6.85 in length of head [2]).

Body robust, its width 1.4 in its depth. Depth of head subequal to the postorbital region; diameter of eye 2.4 in the snout; interorbital region feebly convex. Maxillary extending to below the anterior border of the eye, its distance from which is 3, its greatest width 2.2 in the eye-diameter; lower jaw without fleshy appendage. Premaxillary teeth about 54 on each ramus; posterior canine much the larger; 4 enlarged palatine teeth, the second the strongest; mandible with 9 lateral teeth, the canine sinistral. Opercle with a weak spine. Cheeks and opercles scaly; upper surface of head naked.

Dorsal fin originating well in advance of the tip of the appressed pectoral; dorsal spines flexible, the second the longest, 1.35 in the length of the snout; soft dorsal higher than the spinous, its last ray produced. Anal originating below the middle of, terminating well behind, and similar in size and shape to the soft dorsal. Middle caudal rays 3 in the upper and longer lobe; depth of peduncle one and one sixth time the diameter of the eye. Pectoral fin 1.25 in the length of the

1) The word Senuk is not malay but derived from the dutch snoek (pronounce: snook) = pike, which name is used by the dutch colonists for different species of *Sphyraena*.

2) In the original erroneously is said "body" instead of "head".

snout and extending well beyond the origin of the ventral. Ventral inserted below the origin of the spinous dorsal and midway between the tip of the mandible and the middle of the anal, its length 1.45 in the snout.

No elongate gill-raker.

Above purple, each of the scales with a light centre; sides silvery, crossed by fourteen vertical purple bars, the first behind the tip of the pectoral, the last above the end of the anal; lower surface pearly white; dorsal fins blackish; caudal grayish brown, darkest above; anal, ventrals, and pectorals gray, the anterior rays of the former and the outer rays of the two latter dusky. Total length 405 mm." [Description from a single specimen after J. DOUGLAS OGILBY, not seen by us].

Habitat: Aru Islands.

3. Sphyraena forsteri C.V.

Sphyraena forsteri Cuvier & Valenciennes, Hist. Nat. Poissons III. 1829, p. 353; VII. 1831, p. 509.

Sphyraena forsteri? Bleeker, Verh. Bat. Gen. XXVI. 1854—1857, Sphyraen. p. 13; Nat. Tijdschr. Ned. Indië VII. 1854, p. 424.

Sphyraena forsteri Günther, Cat. Brit. Mus. II. 1860, p. 337.

Sphyraena Forsteri Steindachner, Sitzber. Akad. Wien Bd. 78, 1. Abt. (1878) 1879, p. 382.

Sphyraena forsteri Jordan & Evermann, Proc. U. S. Nat. Mus. XXV. 1902, p. 333.

Sphyraena toxeuma Fowler, Journ. Acad. Nat. Sci. Philadelphia (2) XII. 1904, p. 502.

Sphyraena forsteri Kendall & Goldsborough, Mem. Mus. Comparat. Zool. Harvard Coll. XXVI. No. 7, 1911, p. 262.

D^{1}. V; D^{2}. I. 9; A. II $\frac{15}{18}$; P. 1.13; V. I.5; L.l. 110—120; L.tr. 1.

Height 6.4—7, 7.6—8.3 in length with caudal. Head 3, 3.6 in length with caudal. Eye 4.5—4.7, twice in snout, somewhat more than interorbital space, 1.3—1.4 in postorbital part of head. Maxillary reaching about to vertical through frontborder of eye, 2.3—2.4 in head. Angle of praeoperculum rounded. Operculum with a flexible spine. A series of small teeth, with two canines in front, in the upper jaw. On the palatines 4—7 canines, followed by smaller ones. Teeth in the lower jaw directed slightly backwards; in a single series, distant, increasing in size posteriorly. Rasplike teeth on tongue. Origin of first dorsal above tip of pectorals and somewhat behind origin of ventrals. Second spine of first dorsal longest, shorter or much shorter than postorbital part of head. Base of second dorsal

2.2—2.6 in distance between two dorsals. Origin of anal below fourth ray of second dorsal. Pectorals somewhat longer than postorbital part of head. Ventrals shorter than pectorals. Caudal forked. Colour of alcohol specimens brownish above, silvery below. Length 475 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Nom. indig.: Senuk (Batavia).

Habitat: Sumatra (Padang, Benkulen); Java (Batavia, Cheribon!); Bali; Timor; Borneo (Sandakan); Celebes (Makassar, Menado); Sangir-Islands; Ambon; New Guinea. — Calcutta, Formosa, Fiji-Islands.

In sea.

4. Sphyraena picuda Bl. Schn.

Sphyraena sphyraena Forskål, Descr. Animalium 1775, p. 16 (nec L.).
Sphyraena sphyraena var. *picuda* Bloch, Schneider, Syst. Ichth. 1801, p. 110.
Sphyraena barracuda Cuvier & Valenciennes, Hist. Nat. Poissons III. 1829, p. 343.
Sphyraena Commersonii Cuvier & Valenciennes, ibid. p. 352.
Sphyraena Dussumieri Cuvier & Valenciennes, ibid. VII. 1831, p. 508.
Sphyraena agam Rüppell, Neue Wirbelthiere, Fische 1835, p. 99.
Sphyraena Commersonii Bleeker, Verh. Bat. Gen. XXII. (1848) 1849, Bijdr. Percoïden p. 55; Nat. Tijdschr. Ned. Indië VII. 1854, p. 425; Verh. Bat. Gen. XXVI. 1854—1857, Bijdr. Sphyraenoïden, p. 15.
Sphyraena picuda Günther, Cat. Brit. Mus. II. 1860, p. 336.
Sphyraena Commersoni Günther, ibid. p. 338.
?*Sphyraena dussumieri* Günther, ibid. p. 339.
Sphyraena agam Günther, ibid. p. 341.
Sphyraena Commersoni Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 265.
Sphyraena agam Klunzinger, Abh. zool. bot. Gesellsch. Wien Bd. XX. 1870, p. 822; Fische des Rothen Meeres I. 1884, 4°, p. 129.
Sphyraena commersoni Day, Fishes of India 4°, 1878—1888, p. 343.
Sphyraena picuda Jordan & Evermann, Fishes North & Middle America, part I. 1896, p. 823.
Sphyraena snodgrassi Jenkins, Bull. U. S. Fish Comm. XIX. (1899) 1901, p. 388.
Sphyraena snodgrassi Fowler, Proc. Acad. Nat. Sc. Philadelphia LV. 1904, p. 749.
Sphyraena snodgrassi Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 142.
Sphyraena commersoni Jordan & Richardson, Bull. U. S. Bur. Fish. 1908, p. 245.
Sphyraena picuda M. Weber & de Beaufort. Zool. Mededeel. VI. Leiden 1921, p. 70.

D^1. V; D^2. 2—8; A. 2.7; P. 13; V. 1.5; L.l. ± 80; L.tr. $\frac{13}{1}$.
$\frac{}{14}$

Height 5.8—7.2, 7.1—8.6 in length with caudal. Head 2.8—3, 3.4—3.7 in length with caudal. Eye 6—6.4, 2.4—2.8 in snout, somewhat less than interorbital space, more than twice in postorbital part of head. Maxillary reaching nearly or quite below frontborder of eye, 2.2—2.4 in head. Angle of prae-

operculum rounded. Operculum with two flat flexible spines at the superior part of its hindborder, inconspicuous in adults. Upper jaw with a single series of conical teeth, which are directed backwards and with four canines in front. Lower jaw with a series of somewhat larger teeth, which are vertical. One canine at symphysis. Palatines with a row of 4—8 distant canines of unequal length and a series of small teeth behind them. Lower jaw with a fleshy knob at symphysis. Origin of first dorsal above tip of pectorals and somewhat behind origin of ventrals; its three first spines subequal, shorter than postorbital part of head. Distance between two dorsals twice length of base of second dorsal. Anal and second dorsal subtruncate. Origin of anal below first half of second dorsal. Pectorals about equal to postorbital part of head. Ventrals truncate, scarcely shorter than pectorals. Caudal forked. Colour of alcohol specimens silvery, brownish above. Upper part of first dorsal, greater part of second dorsal and middle rays of caudal and anal black. Pectorals and ventrals yellowish, middle rays of ventrals sometimes blackish. Lenth 1800 mm.

Nom. indig.: Senuk (Batavia), Tunel (Samarang), Haluhalu (Balikpapan), Tangkuloh (Simalur).

Habitat: Singapore; Simalur!; Nias!; Java (Batavia, Samarang, Surabaya); Madura; Kangeang Island!; Borneo (Balikpapan!); Celebes (Makassar!, Kema); Buton!; Ambon; Timor; Ternate; Halmahera; Waigeu!. — Indic and Pacific: From Red Sea and Madagascar to Philippines, Riu Kiu and Hawaiian-Islands. West-Atlantic: West Indies and Brazil, north to the Bermuda Islands.

In sea.

5. **Sphyraena japonica** Schlegel.

Sphyraena japonica? Cuvier & Valenciennes, Hist. Nat. Poissons III. 1829, p. 354 (description insufficient).

Sphyraena japonica Schlegel, Fauna Japonica 1844—1846, p. 33.

Sphyraena japonica Bleeker, Verh. Bat. Gen. XXVI. 1854—1857, Nieuwe Nalezingen Ichth. Japan, p. 67.

Sphyraena japonica Bleeker, Act. Soc. Sc. Ind. Neerl. VIII. 1860, Dertiende Bijdr. Celebes, p. 37.

?*Sphyraena japonica* Jordan & Evermann, Proc. U. S. Nat. Mus. XXV. 1902, p. 333.

D^1. V. 1—2; D^2. 8—9; A. II. 7—8; P. 1.11; V. 1.5; L.l. circa 110.

Height 6.6, 7.8 in length with caudal. Head 3, 3.5 in length with caudal. Eye 5.7, 2.4 in snout, slightly more than inter-

orbital space, a little more than twice in postorbital part of head. Maxillaries reaching almost or quite to vertical through frontborder of eye, 2.4 in head. Angle of praeoperculum rectangular. A series of numerous small teeth in upper jaw, with one or two canines in front, a series of similar teeth on palatines, preceded by 3 canines; teeth of lower jaw vertical, distant, increasing in size posteriorly. A single canine at symphysis. Rasplike teeth on tongue. Origin of first dorsal behind tip of pectorals and before origin of ventrals. Second spine of first dorsal the longest and equal to $^2/_3$ of postorbital part of head. Distance between the two dorsals equal to twice base of second dorsal. Origin of anal below 7th ray of second dorsal. Pectorals about 2.5 in head, ventrals much shorter, about 4 in head. Caudal deeply forked. Length 275 mm. [A specimen from Japan of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Celebes (Menado). — Japan, Formosa?

Note. BLEEKER l.c. 1860, mentions this species in a list of fishes from Celebes. This is the only record of the species from the indo-australian Archipelago ever made. Although BLEEKER's lists are generally very accurate, we are not sure that in this case he did not make a mistake. There is no specimen from Celebes in BLEEKER's collection in the Leiden or Amsterdam Museum.

6. Sphyraena obtusata C.V.

? *Sphyraena chinensis* Lacépède, Hist. Nat. Poissons III. 1803, p. 324; pl. 10, fig. 2.
Sphyraena obtusata Cuvier & Valenciennes, Hist. Nat. Poissons III, 1829, p. 350.
Sphyraena flavicauda Rüppell, Neue Wirbelthiere, Fische des Rothen Meeres, 1835, p. 100.
Sphyraena obtusata Bleeker, Nat. Tijdschr. Ned. Indië VII. 1854, p. 364. — Verh. Bat. Gen. XXVI. 1854—1857, Bijdr. Sphyraenoïden, p. 17.
Sphyraena obtusata Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1006.
Sphyraena obtusata Günther, Cat. Brit. Mus. II. 1860, p. 339.
Sphyraena obtusata Kner, Novara Exp. Fische, 1865—1867, p. 140.
Sphyraena obtusata Klunzinger, Abh. zool. bot. Ges. Wien, XX. 1870, p. 820. — Fische des Rothen Meeres I. 1884, p. 128.
Sphyraena obtusata Günther, Fische der Südsee, II. 1876, p. 212.
Sphyraena obtusata Day, Fishes of India 4°, 1878—1888, p. 343.
Sphyraena strenua De Vis, Proc. Linn. Soc. N.S. Wales, VIII. 1883, p. 287 [1]).
Sphyraena obtusata Sauvage, Poissons de Madagascar, 1891, p. 411.
Sphyraena obtusata Seale, Occas. Papers Bishop B. P. Mus. I. 1901, p. 66.

1) Fide OGILBY, Mem. Queensl. Mus. II. 1913, p. 92.

Sphyraena forsteri Jordan & Seale, Bull. Bur. Fish. Washington, XXV. (1905) 1906, p. 219 (nec C.V.).

Sphyraena obtusata Jordan & Seale, Bull. Bur. Fish. Washington, XXVI. (1906) 1907, p. 11.

Sphyraena obtusata Evermann & Seale, ibid. p. 60.

Sphyraena obtusata Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard Coll. XXVI. 1911, p. 261.

D^1. V; D^2. I.9; A. 2—3.8—9; P. I.12—15; V. I.5; L.l. 82—85; L. tr. $\frac{7\frac{1}{2}}{10}$.

Height about 6, about 7 in length with caudal. Head 2.8—3.4, 3,4—3.8 in length with caudal. Eye 4.3—4.5, not quite twice in snout, 1.5 in postorbital part of head, considerably more than interorbital space, which goes 1.4 in eye. Maxillaries not reaching to frontborder of eye, 2.4—2.5 in head. Hindborder of praeoperculum gently emarginate, its posterior angle rectangular and somewhat produced into a flexible flap. Operculum without spines. Upper jaw with a series of small pointed vertical teeth and with two pairs of canines in front, the foremost pair being the smaller. Lower jaw with a series of more distant and larger vertical teeth and a single small canine at symphysis. A series of small teeth on palatines, with a few canines in front of them. A slight fleshy knob at end of lower jaw. Origin of first dorsal before vertical through tip of pectorals, and behind origin of ventrals. Its second or first and second spine the longest, longer than postorbital part of head. Distance between origin of first dorsal and snout equal to distance between base of ventrals and end of base of anal. Distance between the two dorsals twice or somewhat less than twice the base of second dorsal. Dorsal and anal emarginate. Origin of anal below first half of second dorsal. Pectorals longer than postorbital part of head. Ventrals somewhat shorter than pectorals. Caudal forked. Colour of alcohol specimens brownish above, silvery below. A faint greyish longitudinal band below lateral line. Fins yellowish. Length 400 mm. [A specimen of BLEEKER's collection in the Amsterdam Museum seen by us].

Nom. indig.: Senuk (Batavia); Alu alu (Surabaya, Banjermassin).

Habitat: Singapore; Nias; Sumatra (Telokbetong, Benkulen, Padang, Priaman, Siboga); Banka; Java (Batavia, Surabaya, Anjer); Borneo (Balikpapan!); Madura; Bali; Java-sea!; Celebes

(Makassar!, Bonthain, Bulukomba, Badjoa, Lagusi, Menado); Ambon; Ceram; Obi; Batjan; Ternate; Halmahera; Waigeu; New Guinea. — From Red Sea and east-coast of Africa and Madagascar, British India, Siam, China, Riu Kiu Islands, Philippines, Australia to Fiji-Islands and New-Zealand.

In sea.

7. Sphyraena langsar Blkr.

Sphyraena langsar Bleeker, Verh. Bat. Gen. XXVI. 1854—1857, Bijdr. Sphyraenoïden p. 19. — Nat. Tijdschr. Ned. Indië VII. 1854, p. 367.
Sphyraena langsar Günther, Cat. Brit. Mus. II. 1860, p. 340.
Sphyraena langsar Klunzinger, Sitzber. Akad. Wien 1880, p. 374.
Sphyraena langsar Evermann & Seale, Bull. Bur. Fish. Washington XXVI. 1906, p. 60.
Sphyraena langsar Jordan & Starks, Ann. Carnegie Mus. XI. Nos. 3—4, 1917, p. 439.

D^1. V; D^2. I.8—9; A. 2—3.8—9; P. 2.12—2.13, vel I.13; V. I.5; L.l. 82—87; L.tr. $\frac{6}{9}$.

Height 6.7—7 in length, 8 in length with caudal. Head 2.9—3, 3.4—3.5 in length with caudal. Eye 4.9—5, 2.3 in snout, slightly more than interorbital space and 1.5—1.6 in postorbital part of head. Maxillaries not reaching to frontborder of eye, 2.6—2.8 in head. Hindborder of praeoperculum gently emarginate, its posterior angle rectangular and somewhat produced into a flexible flap. Operculum without spines. Upper jaw with a series of small, rather crowded pointed teeth and 2 canines on each side in front, the foremost of which is the smaller. Lower jaw with a series of more distant and larger vertical teeth and a single small canine at symphysis. Palatines with a series of small teeth and a few canines in front of them. A slight fleshy knob at symphysis of lower jaw. Origin of dorsal above or slightly behind vertical through tip of pectorals and behind origin of ventrals. Second, or first and second dorsal spine the longest, equal to postorbital part of head. Distance between origin of first dorsal and snout more than distance between the base of ventrals and end of base of anal. Distance between two dorsals twice or somewhat less than twice length of base of second dorsal. Anal and second dorsal emarginate. Origin of anal slightly behind that of second dorsal. Pectorals somewhat longer than postorbital part of head. Ventrals somewhat shorter than pectorals. Caudal forked. Colour of alcohol specimens brownish above, silvery below. Fins yellowish. Length 305 mm.

Habitat: Nias!; Pulu Weh!; Java (Batavia!); Flores!; Celebes (Makassar!, Badjoa, North Celebes); Saleyer; Ambon; Batjan; Ternate; Rotti!. — Ceylon, Philippines, Formosa, North Australia (Port Darwin).

8. Sphyraena brachygnathus Blkr.

Sphyraena brachygnathos Bleeker, Natuurk. Tijdschr. Ned. Indië VII. 1854, p. 368.— Verh. Bat. Gen. XXVI. 1854—1857, Bijdr. Sphyraenoïden p. 21.
Sphyraena brachygnathus Kner, Novara Exp. Fische 1865—1867, p. 139.

D^1. V; D^2. I.8—9; A. 2.8—9; P. 2.11; V. 1.5; L.l. circa 85.

Height about 8, about 9.5 in length with caudal. Head 3, 3.5 in length with caudal. Eye 4.5, twice in snout, 0.7 of interorbital space and 1.5 in postorbital part of head. Maxillaries not reaching to frontborder of eye, 2.7 in head. Posterior border of praeoperculum rectangular and somewhat produced into a flexible flap. Operculum without spines. Upper jaw with a series of small teeth and with 2 canines in front. Lower jaw with a series of larger distant vertical teeth, increasing in size posteriorly. Palatines with a series of numerous small teeth and about 7 canines in front of these. Rasplike teeth on tongue. Origin of dorsal far behind that of ventrals, slightly behind tip of pectorals. Distance between the two dorsals twice as much as base of second dorsal. Origin of anal about below fourth ray of second dorsal. Pectorals about equal to postorbital part of head, ventrals somewhat shorter. Caudal forked. Colour of alcohol specimen silvery, brownish above. Length 328 mm. [Description after a specimen of BLEEKER's collection in the Leiden Museum].

Habitat: Java (Batavia); Batjan. — Australia (Moreton Bay), Ceylon? (KNER).

Note. This species is hardly distinguished from *S. langsar*, the only difference being its somewhat larger eye.

3. Fam. MUGILIDAE.

Oblong, cylindrical anteriorly, more or less compressed posteriorly. Head usually broad and flattened. Head and body covered with rather large cycloid or ciliated scales. No lateral line, but lateral scales often with a pit or streak. Eyes mode-

rate or large, lateral. Mouth terminal or subinferior, usually transverse, laterally not extended, or longitudinally cleft and reaching even to below eye. Jaws equal or the lower included; intermaxillaries protractile. Maxillaries, which are often hidden in a groove between intermaxillary and praeorbital, have no supplemental bone. Teeth absent, or minute dermal, ciliiform ones on lips, or true small teeth at least in upper jaw. First dorsal with four stiff spines, second dorsal well separated from first, longer than it and similar to anal, which has three weak spines. Ventral fins abdominal, more or less approximated to pectorals, which are situated in or above middle of height. Pelvic bones not attached to cleithra, but firmly connected with postclavicles. Caudal emarginate. Fins, except first dorsal, usually more or less covered by scales. Third and fourth superior pharyngeals at each side anchylosed, not bearing teeth, forming a complicated structure, which narrows the oesophageal opening. Lower pharyngeals separate. Gillopenings wide. Gillmembranes separate, free from isthmus. Branchiostegals 5 or 6. Gillrakers long and slender, forming a filtering apparatus. Vertebrae 24—26.

Fishes of moderate size, living along the coasts and in estuaries and freshwater of tropic and temperate regions. Feeding on organic matter contained in mud and sand, which is filtered by the gillrakers and swallowed, while larger and indigestable parts are dejected.

Key to the indo-australian Mugilidae.

1. Cleft of mouth more or less transverse, its lateral extension short and far distant from eye. Mandible with a sharp margin. Upperlip fleshy or not, with or without papillae. Lips sometimes ciliated by minute flexible dermal teeth; no teeth on palate . . . . . *Mugil* p. 231.
2. Cleft of mouth extending on the sides of snout to below eye. Upperlip thick; mandible included, with a rounded margin, the lower lip being thick, with a transversal lamellated cushion-like pad. True small teeth in a narrow band on intermaxillaries; two patches of teeth on vomer present or absent . . *Cestraeus* p. 260.
3. Cleft of mouth extending on the sides of snout, not reaching orbit. Upperlip fleshy. Anterior margin of mandible sharp; lower lip thin, without a lamellated apparatus. Small teeth in a single series on intermaxillaries . . . . . *Myxus* p. 264.

1. Mugil Linné.

(Linné, Syst. nat. edit. Xa. 1758, p. 316).

Body oblong, more or less compressed, sometimes anteriorly depressed. Head rather large, convex or depressed, scaly above and on sides. Cleft of mouth more or less transverse, its lateral extension short and ending far distant from orbit. Mouth usually subinferior, formed by intermaxillaries, the maxillaries being small, only their end visible or concealed by the well developed praeorbitals. Mandibles with a sharp margin. Upperlip fleshy or narrow, with or without papillae. Lips some-

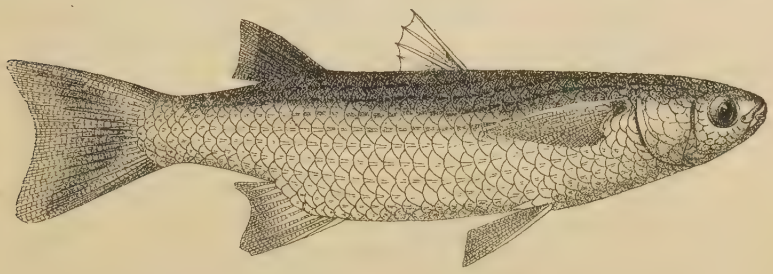

Fig. 67. *Mugil labiosus* C.V. × 3/7.

times ciliated by minute, flexible dermal teeth; no teeth on palate. Eye large, with or without an anterior and posterior gelatinous eyelid, covering part of the iris.

For other characters see those of the family.

The numerous species are living in shoals in sea along the shores, in brackish estuaries entering freshwater of rivers, occuring in all tropical and temperate regions, forming a common food-fish of considerable importance. Some species have a very wide, *Mugil cephalus* L. even a nearly world-wide distribution.

Remark: We use as primary distinguishing characters the number of scales counted in a lateral line from gillopening to the small scales on root of caudal; the position of the median fins opposite to these scales; the number of the soft rays of the anal; the length of the pectorals and their extension along the "lateral line"; the development of a gelatinous eyelid; the character of the upperlip and if the maxillaries are visible or not. Discrepancies between our statement about the number of lateral scales and those of Bleeker are explained by the fact, that Bleeker also counted the small scales on base of caudal.

Key to the indo-australian species of the genus Mugil.

I. Upper lip not particularly thick; gelatinous eyelid well developed, covering at least a third of the iris posteriorly.

A. Anal with 9 soft rays.

1. L.l. 28—31. Maxillary visible. Snout equal to or shorter than eye. First dorsal spine slightly nearer base of caudal than to end of snout or midway between them. Anterior half of anal before second dorsal, the origin of which is opposite to 18th—20th lateral scale. Pectorals shorter than head . . . . . *M. dussumieri* p. 235.

2. L.l. 33—35.

a. Maxillary visible. Snout equal to or longer than eye. First dorsal spine in adult much nearer to end of snout than to base of caudal. First third of anal before origin of second dorsal, the origin of which is opposite to 21st—23rd lateral scale. Pectorals much shorter than head. Least height of caudal peduncle $1^2/_3$—2 in head. *M. tade* p. 236.

b. Maxillary hidden or nearly so when mouth is closed. First dorsal spine about midway between end of snout and base of caudal. Least height of caudal peduncle more than twice in length of head.

α. Pectorals much shorter than head; reaching to 8th—9th lateral scale. Caudal peduncle about $^2/_5$ of length of head . . . . . *M. engeli* p. 238.

β. Pectorals about equal to head, reaching to 12th—13th lateral scale. Caudal peduncle about twice in head . . . . . *M. longimanus* p. 239.

3. L.l. 36—38; extremity of maxillary visible. First dorsal spine nearer to end of snout than to base of caudal. First third of anal before origin of soft dorsal, the origin of which is opposite to 22nd lateral scale. Pectorals not much or nearly not shorter than head. Caudal peduncle about equal to postorbital part of head. . . . . *M. ophuyseni* p. 240.

4. L.l. 40—43. First dorsal spine nearer to end of snout than to base of caudal. First third of anal before origin of soft dorsal, the origin of which is opposite to 25th lateral scale. Maxillary visible.

a. Dorsal and anal scaly. Pectorals equal to or (in adult) somewhat longer than head. Least height of caudal peduncle 2 or more in head. *M. speigleri* p. 241.

b. Dorsal and anal not scaly. Pectorals much shorter than head. Least height of caudal peduncle less than twice in head . . . . . *M. cunnesius* p. 242.

B. Anal with 8 soft rays. Maxillary visible. Upperlip not ciliated. Origin of first dorsal nearer to caudal than to end of snout; that of second dorsal opposite to 19th or 20th lateral scale and behind first third of anal. Pectorals shorter than head . *M. subviridis* p. 243.

II. Upper lip not particularly thick. Gelatinous eyelid very small or wanting.

A. Anal with 8 soft rays; maxillary not visible. L.l. 27—28. Pectorals blackish . . . . . *M. vaigiensis* p. 244.

B. Anal with nine soft rays.

1. L.l. 26—28 (29). Maxillary visible. First dorsal spine nearer to base of caudal than to end of snout. First half of anal before second dorsal.

a. L.l. 26. Rostro-dorsal profile convex, 15—16 praedorsal scales. Pectorals not much shorter than head. . . . . *M. oligolepis* p. 245.

b. L.l. 28—29. Rostro-dorsal profile horizontal, 18 praedorsal scales. Pectorals much shorter than head. . . . . *M. melinopterus* p. 246.

2. L.l. 30—31. Maxillary visible. Snout pointed. First dorsal spine much nearer to base of caudal than to end of snout. Origin of second dorsal opposite to 21st lateral scale, nearly entirely behind anal. Pectorals shorter than head, with an axillary scale. Least height of caudal peduncle equal to or more than its length and equal to postorbital part of head . . . . . *M. ceramensis* p. 247.

3. L.l. 31—35. Maxillary visible. Snout obtuse. First dorsal spine much nearer to base of caudal than to end of snout. Pectorals shorter than head, without axillary scale.

a. L.l. 31—33. Origin of second dorsal opposite to 21st—23rd lateral scale and to first third of anal. Least height of caudal peduncle equal to its length and twice in head. 19—20 praedorsal scales . . . . . *M. troscheli* p. 248.

b. L.l. 32—34. Origin of second dorsal oppo-

site to 20th lateral scale and nearly totally behind anal. Least height of caudal peduncle less than its length and less than twice length of head. 18—21 praedorsal scales . . . . . *M. borneensis* p. 249.

4. L.l. 36—40. Maxillary hidden. First dorsal spine about in the middle between base of caudal and end of snout. Height of caudal peduncle more or less than twice in length of head.

a. L.l. 36—38. Rostro-dorsal profile convex. Pectorals longer than head . . . . . *M. caeruleomaculatus* p. 250

b. L.l. 38—40. Pectorals shorter than head.

α. Rostro-dorsal profile convex. Upperlip smooth. Pectorals reaching to origin of first dorsal. Origin of second dorsal and anal opposite. Anal not or only slightly before second dorsal. Pectorals shorter than head. Least height of caudal peduncle $1^3/_4$ to somewhat more than twice in head. . . . . *M. seheli* p. 252.

β. Rostro-dorsal profile nearly horizontal, snout depressed. Upperlip ciliated. Pectorals reaching to 9th or 10th lateral scale. Origin of anal before that of second dorsal. . . . . *M. cephalus* p. 253.

III. Upper lip very thick. Gelatinous eyelid wanting. Anal with 9 soft rays.

a. L.l. 39—42. Maxillary hidden or nearly so. Origin of second dorsal opposite to 24th or 25th lateral scale; slightly behind that of anal.

1. Lower part of upperlip with about 4 series of papillae. Lower lip laterally papillate. Pectorals shorter than head. . . . . *M. crenilabis* p. 256.

2. Inferior border of upperlip with a single series of very conspicuous obtuse papillae, more or less fimbriate or denticulate. Lower lip with similar papillae. Pectorals as long as head . . . . . *M. macrochilus* [1]) p. 257.

3. Upperlip with or without one indistinct series of obtuse papillae. Lower lip without papillae. Pectorals as long as or longer than head. *M. heterochilus* p. 258.

1) The position of second dorsal is not known, as it is not described by BLEEKER.

· *b*L.l. 34—36. Extremity of maxillary visible. Lower part of upperlip with a shallow groove provided with one series of pointed papillae. Origin of second dorsal opposite to 23rd or 24th lateral scale and to posterior half of anal. Pectorals as long as or longer than head . . *M. labiosus* p. 259.

1. Mugil dussumieri C.V.

Mugil Dussumieri Cuvier & Valenciennes, Hist. Nat. Poissons XI. 1836, p. 147.
Mugil javanicus Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 701 (nomen nudum).
Mugil sundanensis Bleeker, ibid. IV. 1853, p. 265.
Mugil brachysoma Bleeker, ibid. IX. 1855, p. 399 (juvenis abnormis).
Mugil sundanensis Bleeker, ibid. XVI. 1858—1859, p. 276.
Mugil Valenciennesii Bleeker, ibid. p. 277.
Mugil sundanensis Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Dertiende Bijdr. Vischfauna Borneo, p. 45.
Mugil sundanensis Günther, Cat. Brit. Mus. III. 1859—1861, p. 425.
Mugil sundanensis Day, Fishes of Malabar, 1865, p. 138.
Mugil Meyeri Günther, Ann. Mag. Nat. Hist. (4) IX. 1872, p. 439.
Mugil dussumieri Day, Fishes of India 4°. 1878—1888, p. 352.
Mugil sundanensis Evermann & Seale, Proc. U. S. Nat. Mus. XXXI. 1906, p. 506.
Mugil sundanensis Jordan & Seale, Bull. Bur. Fish. Wash. XXXI. (1906) 1907, p. 11.
Mugil Dussumieri Max Weber, Nova Guinea V. Zool. Livr. 2, 1908, p. 243.
Mugil dussumierii Mc Culloch, Check-list of fish of New South Wales, Prt. II. 1919, p. 38. — Rec. Austr. Mus. vol. XIII. No. 4, 1921, p. 126.

D^1. IV; D^2. I. 8—9; A. III. 9; P. 15; L.l. 28—30; L.tr. 10—11.

Rostro-dorsal profile straight. Height according to size 3.2—4.4 in length, 4—5.3 in length with caudal. Head 3.8—4 in length, 4.6—5.7 in length with caudal. Eye 4.2—4.7 in head, 2.3—2.6 in postorbital part of head; posterior part of gelatinous eyelid well developed, covering iris totally or nearly so. Interorbital space flat or nearly so, 2.3—2.7 in length of head, more or less than twice the diameter of the eye. Snout equal to or shorter than eye, depressed, its frontborder formed by upperlip, which is conspicuously ciliated. Maxillary visible when mouth is closed. Praeorbital scaly, slightly notched, denticulated. Mandible with a single symphysial knob. First dorsal with strong spines, in males somewhat shorter than head without snout; its origin slightly nearer base of caudal than to end of snout or midway between them, opposite to 9th or 10th lateral scale, separated from snout by 18—20 praedorsal scales, at its base a long axillary scale. Origin of second dorsal opposite to (18th) 19th or 20th scale. Anterior half of anal before second dorsal. Both fins are thickly scaled, emarginate, as high as,

lower or higher than spinous dorsal. Pectorals shorter, in large specimens much shorter than head, reaching to 7th or 8th lateral scale; without an axillary scale or only with a small one. Caudal broad, more or less concave, with more than half its base scaly. Caudal peduncle about as long as high, its length about $^2/_3$ of length of head or somewhat more. Greenish above, silvery below, often with three to six more or less conspicuous blackish longitudinal stripes, corresponding to the longitudinal series of the scales on the sides of the body. Length to 300 mm. [Specimens of *M. sundanensis* and of *M. Valenciennesii* of BLEEKER's collection in the Museum of Leiden and Amsterdam seen by us].

Nom. indig.: Bale balana (Minralang river).

Habitat: Singapore!; Sumatra (Bagan api api!, Lower Langkat, Coast of Deli!, Benkulen, Trussan, Padang); Bintang; Banka; Borneo (Sinkawang, Stagen!, Balikpapan!, Kota Baru!); Java Sea!; Java (Bantam, Batavia!, Perdana, Semarang!, Pasuruan); Bali; Lombok!; Flores!; Timor; Buton!; Celebes (Makassar!, Lake of Sidenreng!, river Minralang!); Dammer Island! (rivulet); New Guinea (Rivers Merauke! Tawarin!, mouth of Sermowai!, Otke, branch of river Mamberamo!). — British India, Andamans, Ceylon, Philippines, Australia (New south Wales?, Queensland).

2. Mugil tade Forsk.

Mugil tade Forskål, Descr. Anim. 1775, p. 74.
Mugil planiceps Cuvier & Valenciennes, Hist. nat. Poiss. XI. 1836, p. 122.
Mugil cephalotus Cantor, Cat. Malayan Fish. Journ. Asiat. Soc. Bengal, XVIII. Prt. II. 1850, p. 1077 (nec C.V.).
Mugil bontah Bleeker, Verh. Bat. Gen. XXV. 1853, Nalezingen ichth. fauna Bengalen etc. p. 48 (name only).
Mugil planiceps Bleeker, ibid. p. 101.
Mugil bontah Bleeker, Nat. Tijdschr. Ned. Indië XIII. 1857, p. 336.
Mugil belanak Bleeker, ibid. p. 337.
Mugil Dussumieri Bleeker, ibid. p. 339 (nec *Dussumieri* Blkr. Journ. Ind. Arch. II. 1848, p. 637 secundum Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 8ste Bijdr. Vischfauna Sumatra, p. 33; ibid. 13de Bijdr. Vischfauna Borneo, p. 49).
Mugil bontah Bleeker, ibid. XVI. 1858—1859, p. 278.
Mugil bontah Bleeker, ibid. XVIII. 1859, p. 367 (= *belanak* secundum Bleeker).
Mugil bontah Bleeker = *dussumieri* C.V.? Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13de Bijdr. Vischfauna Borneo, p. 49.
Mugil belanak Günther, Cat. Brit. Mus. III. 1859—1861, p. 427.
Mugil planiceps Günther, ibid. p. 428.
Mugil planiceps Kner, Fische Novara-Exp. 1865—1867, p. 225.

Mugil tade Klunzinger, Abhandl. zool.-bot. Ges. Wien XX. 1870, p. 828. — Sitzber. Akad. Wien, 1880, p. 394. — Fische d. Rothen Meeres 1884, p. 133.
Mugil planiceps Day, Fishes of India 4°, 1878—1888, p. 350.
Mugil belanak Day, ibid. p. 351.
Mugil tade Macleay, Proc. Linn. Soc. N. S. Wales IX. 1884, p. 40.
Mugil tade Day, Fishes Brit. India II. 1889, p. 344.
Mugil belanak Day, ibid. p. 345.
Mugil belanak Vinciguerra, Ann. del Mus. Civ. Genova (2) IX. 1890, p. 180.
? *Mugil belanak* Fowler, Proc. Acad. Nat. Sc. Philad. (2) LVII. 1905, p. 494.
Mugil belanak Max Weber, Nova Guinea V. 1908, p. 244.
Mugil planiceps Max Weber, Nova Guinea IX. Zool. Livr. 4, 1913, p. 569.

D^1. IV; D^2. I. 8—9; A. III. 9; L. l. 33—35; L. tr. $10^1/_2$.

Rostro-dorsal profile nearly straight, from crown of head to snout strongly declivous. Height according to size 4.2—5.2 in length, 5.1—6.7 in length with caudal. Head, the anterior part of which is depressed and pointed, 3.7—4 in length, 4.5—5.1 in length with caudal. Eye 3 in small, to 4.6 in full grown specimens, 1.5—2.5 or somewhat more in postorbital part of head. Posterior gelatinous eyelid covering at least half of iris. Interorbital space, which is nearly flat, 1.5 to 2.5 or somewhat more the diameter of the eye. Snout somewhat pointed, equal to, in full grown individuals longer than eye. Praeorbital emarginate, strongly curved, reaching far beyond corner of mouth with its posterior part, which is somewhat rounded; inferior and posterior margin denticulated. Maxillary visible when mouth is closed, reaching beyond angle of praeorbital. Upper lip more or less fleshy, its border ciliated (teeth). Symphysial knob single. Origin of first dorsal nearer to end of snout than to base of caudal, in small specimens about in the middle; opposite to 10th or 11th scale, separated from snout by about 19 praedorsal scales and slightly lower than second dorsal, the origin of which is opposite to 21st—23rd lateral scale and to about first anterior third of anal; both lastnamed fins are slightly concave and scaly. Caudal slightly emarginate. Pectorals reaching to 8th lateral scale, much shorter than head. Their axillary scale very short; that of the ventrals somewhat less than half the length of that fin. Least height of caudal peduncle 1.4—1.8 (in small specimens) in its length and twice or more in length of head. Olivaceous above, silvery below, generally with 5—7 indistinct dark longitudinal lines, corresponding to rows of scales. Length to 320 mm. [According to DAY at least 470 mm.].

Habitat: Singapore; Pulu Weh!; Sumatra (Palembang); Simalur!; Banka; Java (Batavia, Japara, Sūrabaya, Besuki, river from East Java!); Java Sea!; Madura; Bali; Lombok!; Sumbawa; Borneo (Sungi duri, Sandakan); Celebes (Makassar!); Ternate; New Guinea (rivers Mosso!, Tawarin!, Sermowai!, Lorentz!; Merauke!). — Red Sea, Sokotra, Bay of Bengal, British India, Ceylon, Andamans, Pinang, Malacca, China (Amoy), Philippines, Marianas, Guam, Australia (Clevelands Bay).

3. **Mugil engeli** Blkr.

Mugil Engeli Bleeker, Nat. Tijdschr. Ned. Indië XVI. 1858—1859, p. 277.
Mugil Engeli Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, p. 78, 8ste Bijdr. Vischfauna Sumatra, p. 78.
? *Mugil kelaartii* Günther, Cat. Brit. Mus. III. 1859—1861, p. 429. — Südseefische II. Journ. Mus. Godeffr. 1881, p. 215.
Mugil engeli Günther, Cat. Brit. Mus. III. 1859—1861, p. 430.
? *Mugil kelaarti* Day, Fishes of India 4°, 1878—1888, p. 352.

D^1. IV; D^2. I. 8; A. III. 9; L.l. 32—35; L.tr. 11—12.

Rostro-dorsal profile convex. Height 3.8—4.7 in length, 4.8—5.6 in length with caudal. Head somewhat less than height. Eye about $^1/_3$ of length of head, contained more or less than $1^1/_2$ times in postorbital part of head and about $1^1/_3$ in interorbital space, which is nearly flat; a gelatinous eyelid covers the largest part of the iris. Snout shorter than eye, convex, obtuse, broadly rounded and slightly prominent before frontborder of upperlip. Praeorbital scaly, not or only slightly bent, weakly emarginate, its hindborder broadly truncate with a very fine serrature, its lower border rough. Maxillary entirely hidden or nearly so. Lips thin, smooth, symphysial knob double. Origin of first dorsal about midway between end of snout and base of caudal or slightly nearer to lastnamed; opposite to 10th or 11th lateral scale and separated from end of snout by 18—20 praedorsal scales. Dorsal spines rather slender, about equal to postorbital part of head and as high as or somewhat higher than second dorsal and anal, which are emarginate and scaly at their base. Origin of second dorsal opposite to 20th or 21rst lateral scale, that of anal with its anterior third or half before origin of soft dorsal. Pectorals equal to head without snout or somewhat shorter, reaching to 8th or 9th lateral scale. Their axillary scale large, about $^2/_5$ of the length of the pectoral; a still larger axillary scale at base of ventrals and of spiny

dorsal. Caudal deeply concave. Least height of caudal peduncle much less than its length, about $^2/_5$ of the length of the head. Silvery, back olivaceous. Fins hyaline. Length 133 mm. [Specimens of BLEEKER's collection in the Leiden and Amsterdam Museum seen by us].

Habitat: Pulu Weh!; Sumatra! (Benkulen); Simalur!; Nias!; Java (Tjilatjap!); Bali.

In sea.

4. Mugil longimanus Gthr.

Mugil cunnesius Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 454 (nec C.V., nec CANTOR).

Mugil cunnesius Bleeker, Nat. Tijdschr. Ned. Ind. XVI. 1858—1859, p. 278 (nec C.V., nec CANTOR).

Mugil cunnesius Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 9. Bijdr. visch-fauna Sumatra, p. 8 (nec C.V., nec CANTOR).

Mugil longimanus Günther, Cat. Brit. Mus. III. 1859—1861, p. 428.

Mugil Engeli Day, Fishes of Malabar, 1865, p. 139 (nec Blkr.).

Mugil cunnesius Day, Fishes of India 4°. 1878—1888, p. 349 (nec C.V., nec CANTOR).

Mugil longimanus Steindachner, Denkschr. Akad. Wien XLI. 1879, p. 5.

Mugil longimanus Macleay, Proc. Linn. Soc. N. S. Wales IX. 1884, p. 41.

Mugil cunnesius Waite, Mem. N. S. Wales Nat. Club No. 2, 1904, p. 22.

? *Mugil longimanus* Jordan & Seale, Bull. Bur. Fish. XXVI. (1906) 1907, p. 10.

Mugil longimanus Ogilby, Ann. Queensl. Mus. No. 9, Prt. I, 1908, p. 26.

Mugil longimanus Mc Culloch, Rec. Austr. Mus. vol. XIII. No. 4, 1921, p. 130.

D^1. IV; D^2. I. 8—9; A. III. 9; L.l. 35—37; L. tr. 11—12.

Rostro-dorsal profile convex. Height somewhat more than length of head and 3.6—4 times in length and more or less than 5 times in length with caudal. Eye 3.6—3.8 in length of head and about twice the length of postorbital part; gelatinous membrane well developed, posteriorly covering the iris totally or nearly so. Interorbital space convex, nearly twice the length of the head. Snout convex, blunt, about equal to the diameter of eye. Praeorbital not or only slightly emarginate, conspicuously denticulate and squamate. Maxillary hidden when mouth is closed. Upper lip rather thick. Symphysial knob double. Origin of first dorsal slightly nearer to snout than to base of caudal or midway between them; opposite to 12th—14th lateral scale, separated by 18—19 praedorsal scales from snout. Dorsal spines moderate, with a long axillary scale below their base, lower than second dorsal and anal, which are emarginate and thickly covered by scales. Origin of second dorsal opposite to 21st—24th lateral scale, behind origin of anal, which is

opposite to 19th—23rd lateral scale. Length of pectorals about equal to length of head, reaching at least to origin of first dorsal, provided with a long axillary scale, which goes about $2^1/_2$ times in length of fin. Ventrals also provided with a long pointed axillary scale. Caudal slightly emarginate, scaly at its base. Least height of caudal peduncle about $1^1/_3$ in its length and about equal to half length of head. Greenish above, silvery below. Base of pectorals superiorly with a diffuse dark mark. Length 223 mm.

Habitat: Singapore; Sumatra (Padang, Benkulen, Telokbetong, Trussan); Java Sea!; Java! (Bantam, Batavia, Tegal, Pekalongan, Semarang, Surabaya, Pasuruan, Puger!, Besuki); Madura; Celebes (Menado, Makassar!); Buru; Ambon; Moluccos. — British India, Pinang, Philippines, Queensland (STEINDACHNER).

5. **Mugil ophuyseni** Blkr.

Mugil Ophuysenii Bleeker, Nat. Tijdschr. Ned. Ind. XVI. 1858—1859, p. 279.
Mugil Ophuysenii Bleeker, Act. Soc. Sc. Ind. Neerl. VIII. 1860, 8ste Bijdr. Vischfauna Sumatra, p. 82.
Mugil ophuysenii Günther, Cat. Brit. Mus. III. 1859—1861, p. 434.
Mugil ophuysenii Kner, Fische Novara-Exp. I. 1865—1867, p. 226.
Mugil Ophuysenii Max Weber, Fische, Siboga-Expeditie, 1913, p. 140.

D^1. IV; D^2. I. 8—9; A. III. 9; P. 2.13—14; V. 1.5; L.l. 36—38; L. tr. 12—13.

Rostro-dorsal profile convex. Height somewhat more than length of head, which goes less than 5 times in length and about 4 times in length without caudal. Eye 3.5 or somewhat more in head and about twice in its postorbital part; a gelatinous eyelid of some extent is present. Interorbital space convex, nearly equal to postorbital part of head. Snout somewhat pointed, strongly convex, shorter than eye. Maxillaries visible when mouth is closed. Praeorbital only slightly emarginate, its descending part rather small, truncate and denticulate. Symphysial knob double. Origin of first dorsal nearer to end of snout than to base of caudal; it is opposite to 12th scale of lateral line and separated by 22 praedorsal scales or less from end of snout; dorsal spines not strong, nearly equal to postorbital part of head. Origin of second dorsal opposite to 22nd scale of lateral line and to second third of anal, the origin of which is opposite to 20th scale. Second dorsal and anal are

strongly concave and scaly. Pectorals about as long as head, reaching to origin of first dorsal; their axillary scale shorter than half length of fin. Axillary scale of ventrals longer than half their length. Caudal emarginate. Least height of caudal peduncle about equal to postorbital part of head and nearly one fifth shorter than length of peduncle. Silvery with a greyish back, fins hyaline, axil of pectorals with a dark spot. Length 200 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: Sumatra (Benkulen!); Java (KNER); Lirung (Salibabu Island)!.

In sea.

6. Mugil speigleri Blkr.

Mugil Speigleri Bleeker, Nat. Tijdschr. Ned. Indië XVI. 1858—1859, p. 279.
Mugil Speigleri Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13. Bijdr. vischfauna Borneo, p. 58.
Mugil speigleri Günther, Cat. Brit. Mus. III. 1859—1861, p. 435.
Mugil speigleri Day, Fishes of India 4°, 1878—1888, p. 348 (pectoral in figure to short).

D^1. IV; D^2. I. 8; A. III. 9; L.l. ca. 40; L.tr. 12.

Rostro-dorsal profile more or less convex. Height about equal to head, 4.2 to more than 5 in length, caudal included. Eye 3.4—3.8 in length of head, which is rather obtuse and twice or somewhat less in postorbital part of head; gelatinous membrane anteriorly and posteriorly well developed. Interorbital part of head slightly convex, more than $2^1/_2$ times in length of head. Snout obtuse, convex, shorter than eye. Praeorbital bone scaly, rather small, not curved or emarginate. Maxillary visible, exceeding posterior margin of praeorbital, the denticulation of which is nearly invisible. Symphysial knob nearly simple. Origin of first dorsal separated by about 20 praedorsal scales from snout, much nearer to end of snout than to base of caudal and opposite to 12th lateral scale. Dorsal spines moderately strong, about equal to length of postorbital part of head, about as high as second dorsal, which is lower than anal, the base of which is much longer than second dorsal. Both fins are covered by small scales and deeply concave. Origin of second dorsal opposite to 25th—26th lateral scale and to first third of anal, the origin of which is opposite to 23rd or 24th lateral scale. Caudal emarginate with acute angles. Pectorals about equal to length of head or in adult

somewhat longer, surpassing origin of first dorsal; their pointed axillary scale is nearly half length of the fin and equal to axillary scale of ventrals, which is strongly pointed. Least height of caudal peduncle about $1^1/_2$ times in its length and twice or more than twice in length of head. Silvery, greyish along the back, a dark spot at upper edge of base of caudal, extremity of median fins dusky. Length 225 mm. [Specimens of BLEEKER's collection seen by us in the Museum of Leiden and Amsterdam].

Habitat: Java Sea!; Java (Batavia); Borneo (Sinkawang); Halmaheira. — Malay Peninsula; Coast of British India; Balutchistan (ZUGMAYER).

In sea.

7. Mugil cunnesius C.V.

Mugil cunnesius Cuvier & Valenciennes, Hist. nat. Poissons, XI. 1836, p. 114.
Mugil cunnesius Cantor, Cat. Malayan Fish. Journ. Asiat. Soc. Bengal vol. XVIII. Prt. II, 1850, p. 1082.
Mugil cunnesius Günther, Cat. Brit. Mus. III. 1859—1861, p. 434 (nec Blkr.).
Mugil cunnesius Klunzinger, Fische d. Rothen Meeres 1884, p. 132 (nec Rüpp., nec Klunz. 1870, p. 830).
Mugil cunnesius Ogilby, Ann. Queensl. Mus. No. 9, Part. I. 1908, p. 26.

D^1. IV; D^2. I. 8; A. III. 9; L.l. 42—43; L.tr. 13.

Height subequal to length of head, about $^1/_4$ of length, $^1/_5$ of length with caudal. Diameter of eye $^1/_5$ of length of head and twice its postorbital part, posteriorly with a gelatinous membrane. Interorbital space very slightly convex, its width being $^2/_5$ of the length of the head. Snout short, obtuse, equal to diameter of eye. The praeorbital has the anterior margin nearly straight, neither toothed nor notched; it does not entirely cover the maxillary, the extremity of which is visible behind the angle of the mouth. Lips thin. Origin of first dorsal separated by 22 scales from snout; opposite to 12th lateral scale and nearer to end of snout than to base of caudal. Anterior dorsal spines exceeding somewhat one half of length of head. Second dorsal opposite to 25th lateral scale and to third anal ray. Caudal slightly emarginate. Vertical fins without scales. Pectorals much shorter than head, reaching to 12th lateral scale or to origin of first dorsal, with a long axillary scale, nearly half the length of the fin. Least height of caudal peduncle less than one half the length of the head. Bluish green above, silvery below; dorsal and caudal fins with indistinct blackish

margins; sometimes a black spot superiorly at the base of the pectoral. Length 162 mm. [Not seen by us].

Habitat: Singapore; Dutch South New Guinea (REGAN). — Red Sea, Gulf of Manar, Sea of Pinang, Malay Peninsula, Tonkin.

8. Mugil subviridis C.V.

Mugil subviridis Cuvier & Valenciennes, Hist. nat. Poissons XI. 1836, p. 115.
Mugil subviridis Günther, Cat. Brit. Mus. III. 1859—1861, p. 423.
Mugil subviridis Day, Fishes of Malabar, 1865, p. 138.
Mugil subviridis Günther, Ann. Mag. Nat. Hist. (3) XX. 1867, p. 64.
? *Mugil subviridis* Day, Fishes of India 4°, 1878—1888, p. 353. — Fish. of Brit. India II. 1889, p. 348 [1]).
Mugil alcocki Ogilby, Ann. Queensl. Mus. Nr. 9, Part. I. 1908, p. 21.
Mugil subviridis De Beaufort, Bijdr. tot de Dierk. Afl. 19, Amsterdam, 1913, p. 107.
Mugil subviridis Max Weber, Siboga-Exp. Fische, 1913, p. 138.

D^1. IV; D^2. I. 8; A. III. 8; P. 15—16; V. 1.5; L.l. 28—30; L. tr. 11—12.

Rostro-dorsal profile nearly straight. Height equal to or somewhat more than length of head, which goes about 4 times in length and more or less than 5 times in length with caudal. Eye 3.5 to more than 4 in head, twice or less in its postorbital part. Gelatinous eyelid well developed, covering large part of iris. Interorbital space nearly flat, more or less than $2^1/_2$ times in head, much less than twice the diameter of the eye. Snout shorter than eye, broad, somewhat depressed, its frontmargin formed by upperlip, which may be rather thick, but is not ciliated. Symphysial knob rather small, single. Maxillary visible when mouth is closed. Praeorbital more or less angularly bent, denticulate at its inferior and subtruncate posterior border. Origin of first dorsal nearer to caudal than to end of snout, separated by about 20 scales from snout and opposite to 10th or 11th lateral scale. Dorsal spines strong, heteracanth, shorter than head without snout, as high or higher than second dorsal and anal, which both are emarginate and thickly scaled. Origin of second dorsal opposite to 19th or 20th lateral scale and behind first third of anal. Pectorals about equal to head without snout, reaching to 7th or 8th lateral scale. Caudal rather broad, emarginate, scaly. No axillary scale above

1) We are not sure that this is really *M. subviridis* C.V., the type specimen of which DAY says to describe, as VALENCIENNES describes the anal as 3.8 and not 3.9, as DAY says.

pectorals and ventrals, a long one at base of spinous dorsal. Olivaceous above, the sides silvery with or without faint indications of darkish longitudinal bands along the rows of scales. Length 220 mm.

Habitat: Lombok (Labuan Tring!); Buru (Kajeli!); Celebes (Makassar!). — British India, Philippines, Cape York.

In sea and fresh water.

9. Mugil vaigiensis Q.G.

Mugil vaigiensis Quoy et Gaimard, Voyage de l'Uranie et de la Physicienne par Freycinet, Zool. 1824, p. 337.
Mugil macrolepidotus Rüppell, Atlas Fische d. Rothen Meeres, 1828, p. 140.
Mugil macrolepidotus Cuvier & Valenciennes, Hist. nat. des Poiss. XI. 1836, p. 134.
Mugil melanochir (K. v. H.) Cuvier & Valenciennes, ibid. p. 143.
Mugil macrolepidotus Bleeker, Nat. & Geneesk. Arch. Ned. Indië (3) II. 1845, p. 514 (name only).
Mugil melanochir Bleeker, Verh. Bat. Genootsch. XXII. (1848) 1849, Bijdr. ichthyol. fauna van Madura, p. 5 (name only).
Mugil macrolepidotus Cantor, Cat. Malayan Fishes, Journ. Asiat. Soc. Bengal, vol. XVIII. 1850, p. 1077 (nec Rich.).
Mugil melanochir Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 423.
Mugil Rossii Bleeker, ibid. VII. 1854, p. 45.
Mugil vaigiensis Bleeker, Nat. Tijdschr. Ned. Ind. XVI. 1858—1859, p. 276.
Mugil Rossii Bleeker, l.c.
Mugil vaigiensis Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13. Bijdr. Vischfauna Borneo, p. 43.
Mugil waigiensis Günther, Cat. Brit. Mus. III. 1859—1861, p. 435.
Mugil Waigiensis Day, Fishes of Malabar, 1865, p. 144.
Mugil waigiensis Kner, Fische Novara-Exp. I. 1865—1867, p. 226.
Mugil waigiensis Klunzinger, Abh. zool.-bot. Gesellsch. Wien, XX. 1870, p. 828; Fische d. Rothen Meeres I. 1884, p. 133.
Mugil Waigiensis Day, Fishes of India, 4°, 1878—1888, p. 359.
Mugil waigiensis Günther, Südsee-Fische II. Journ. Mus. Godeffr. 1881, p. 216.
Mugil Waigiensis Sauvage, Hist. nat. d. Poiss. de Madagascar. 1891, p. 401.
Mugil waigiensis Seale, Occas. Pap. B. P. Bish. Mus. I. 1901, p. 65.
Liza waigiensis Seale, l. c. IV. 1906, p. 15.
Mugil vaigiensis de Beaufort, Bijdr. tot de Dierk. Afl. 19. Amsterdam. 1913, p. 107.
Mugil Rossi Max Weber, Siboga-Exp. Fische. 1913, p. 138.
Mugil waigiensis Mc Culloch, Check-list of fish & fish-like animals of N. S. Wales, Prt. II. 1919, p. 38.

D^1. IV; D^2. I. 7—8; A. III. 8; L.l. 26—28; L.tr. 9—10.

Rather stout. Rostro-dorsal profile nearly straight, from neck to snout more or less convex. Height slightly less than length of head, which is contained more than 4 to more than 5 times in total length. Head broad and flat above. Eyes without gelatinous eyelid; 4 to nearly 5 times in head. Interorbital

space nearly flat, about twice the diameter of the eye. Snout obtuse, broad, strongly depressed, in young specimens shorter, in adult longer than eye. Praeorbital slightly emarginate, its inferior margin conspicuously denticulated, only end of maxillary visible at angle of mouth when mouth is closed. Lips thin, smooth. Origin of first dorsal nearer to base of caudal than to end of snout, separated by 15 or 16 praedorsal scales from end of snout, opposite to 7th or 8th lateral scale. Dorsal spines rather strong, heteracanth, about equal to postorbital part of head, lower than second dorsal. Origin of second dorsal opposite to 17th or 18th lateral scale, behind that of anal which is opposite to 15th scale. Both fins are scaly. Caudal truncate or nearly so. Pectorals much shorter than head, reaching to first dorsal or not so far, wanting an axillary scale. Ventrals about half length of that fin. Least height of caudal peduncle more than its length and twice or less in length of head. Symphysial knob nearly conical, not divided. Dorsal part dark green, ventrally lighter, the belly silvery. Generally 3rd—8th row of scales with a longitudinal brownish spot, causing 6 longitudinal bands of which the 2nd—5th are broadest and most conspicuous. Margin of fins dusky. Pectorals blackish, entirely black in immature specimens (*melanochir*). Length to 400 mm.

Nom. indig.: Belanak djumpul (Batavia); Gĕreh (Surabaya); Goru (Batjan); Rapang (Bintang).

Habitat: Singapore; Pulu Weh!; Sumatra (Padang, Benkulen); Bintang; Banka; Java Sea!; Java (Batavia, Samarang, Surabaya, Patjitan, Nusa Kembangan!, Karangbollong, Prigi); Madura; Kangeang Island!; Borneo (Sampit); Celebes (Makassar, Badjoa); Saleyer!; Paternoster Islands!; Flores!; Timor; Goram; Ambon!; Batjan!; Ternate; Waigeu!; South and North New Guinea (Sorong!); Cocos (Keeling) Islands. — Red Sea, East Africa, British India, Andamans, Pinang, Malay Peninsula, China, Philippines, New South Wales and Queensland, Melanesian, Micronesian and Polynesian Islands.

In sea, estuaries and fresh water.

10. **Mugil oligolepis** Blkr.

Mugil Dussumieri C.V.? Bleeker, Journ. Ind. Arch. II. 1848, p. 637 (nec C.V., nec Blkr. Nat. Tijdschr. Ned. Ind. XIII. 1857, p. 339 secundum Blkr. l. c. XIX. 1859, p. 437).

Mugil macrolepis Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 422 (nec Smith).

Mugil oligolepis Bleeker, Nat. Tijdschr. Ned. Ind. XIX. 1859, p. 437.
Mugil oligolepis Bleeker, Act. Soc. Sc. Ind. Neerl. VIII. 1860, 13de Bijdr. Vischfauna Borneo, p. 40.
Mugil oligolepis Günther, Cat. Brit. Mus. III. 1859—1861, p. 449.
Mugil oligolepis Day, Fishes of India 4°, 1878—1888, p. 358.

D^1. IV; D^2. I. 8—9; A. III. 9; P. 14; V. 1.5; L.l. circa 26; L. tr. 10—11.

Rostro-dorsal profile somewhat convex. Height somewhat less than length of head, which goes about 3.4 in length and more than 4 times in length with caudal. Eye about 3.5 in head and $1^1/_2$ or more in its postorbital part; a gelatinous eyelid is wanting. Interorbital space slightly convex, conspicuously broader than diameter of eye and less than postorbital part of head. Snout blunt, shorter than eye. Maxillary visible, when mouth is closed. Praeorbital bent, emarginate, its inferior border truncate, denticulate. Lips thin; mandible with an emarginate or double symphysial knob. First dorsal with strong spines, nearly equal to head without snout. Its origin nearer to base of caudal than to end of snout, from which it is separated by 15 to 16 praedorsal scales. It is opposite to 9th scale of lateral line. Origin of second dorsal opposite to 17th or 18th scale and behind anterior half of anal, the origin of which is opposite to 16th scale. Pectorals not much shorter than head, reaching near to origin of first dorsal. No axillary scale above pectorals, a short one above base of ventrals. Caudal slightly emarginate. Caudal peduncle about as long as high, its least height nearly equal to postorbital part of head. Greenish above, silvery below. Length 90 mm. [Specimens of BLEEKER's collection in the Leiden Museum seen by us].

Habitat: South and West Borneo (Pamangkat, Sungiduri, Sampit) in rivers; Sumbawa in sea; North Celebes. — Malacca (Bongor, PETERS, river Muar, DUNCKER); Philippines (JORDAN & RICHARDSON); Saigon (KNER); seas and estuaries of British India (DAY), Seychelles brackish water (REGAN).

11. Mugil melinopterus C.V.

Mugil melinopterus Cuvier & Valenciennes, Hist. Nat. Poissons XI. 1836, p. 146.
Mugil melinopterus Günther, Cat. Brit. Mus. III. 1859—1861, p. 452.
Mugil melanopterus (sic!) Günther, Südseefische II. Journ. Mus. Godeffr. 1881, p. 218.
Liza melinoptera Jordan & Seale, Bull. Bur. of Fish. vol. XXV. (1905) 1906, p. 217.

D^1. IV; D^2. I. 8; A. III. 9; L.l. 28—29; L.tr. 10—11.

Dorso-rostral profile nearly straight, anteriorly convex. Height 4 to $4^2/_3$ times in length with caudal, head 4.5 times. Eye nearly $3^4/_5$ in length of head, twice in postorbital part of head and $1^1/_2$ in interorbital space; without a gelatinous eyelid or posteriorly only with a very short one. Interorbital space flat, broad, its width being nearly one half length of head. Snout obtuse, depressed, somewhat shorter than eye. Praeorbital emarginate, angularly bent, scaly, its truncated extremity and its lower margin dentated. Maxillary visible. Upper lip ciliated, rather thick, forming frontmargin of snout. Symphysial knob single. Origin of first dorsal nearer to base of caudal than to end of snout, separated from it by 18 praedorsal scales, opposite to 9th lateral scale. Dorsal spines rather strong, about as high as second dorsal and anal, the first about $^2/_3$ of the length of the head. Second dorsal opposite to 18th or 19th lateral scale and about to the middle of the anal. Second dorsal and anal scaly at their base. Caudal slightly emarginate. Pectorals about equal to head without snout, not reaching to origin of first dorsal, an axillary scale is wanting or very short. Least height of caudal peduncle more than its length and equal to postorbital part of head. Silvery, back brown, fins dusky. Length 215 mm.

Habitat: Sinabang Bay, Simalur! (E, JACOBSON leg.). — Vanicolo, Tonga Island, Samoa, Fiji Islands.

In sea.

12. Mugil ceramensis Blkr.

Mugil ceramensis Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 699.
Mugil ceramensis Bleeker, ibid. XVI. 1858—1859, p. 277.
Mugil ceramensis Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13de Bijdr. vischfauna Borneo, p. 48.
Mugil ceramensis Günther, Cat. Brit. Mus. III. 1859—1861, p. 449.

D^1. IV; D^2. I. 8—9; A. III. 9; L.l. 30—31; L.tr. 10—11.

Dorso-ventral profile evenly descending and straight or convex; head pointed and nearly straight, 3.7 in length; 4.7 in length with caudal. Height slightly more than head. Eye 3.8 to 4 times in head, about twice in its postorbital part and 1.7 in interorbital space; gelatinous eyelid forming a narrow ring round eye. Interorbital space flat or slightly convex, more than twice in head. Snout acute, about equal to eye. Praeorbital scaly, bent, slightly emarginate, conspicuously denti-

culate at its lower and rounded posterior border. Maxillary visible. Upper lip rather thick, ciliated, forming frontmargin of snout. Symphysial knob simple, small. Origin of first dorsal separated by 18 or 19 praedorsal scales from snout, much nearer to base of caudal than to end of snout, opposite to 10th lateral scale. Dorsal spines somewhat higher than second dorsal, the anterior strong, longer or shorter than postorbital part of head. Second dorsal opposite to 19th—21st lateral scale and nearly totally behind anal, the origin of which is opposite to about 17th lateral scale. Both fins are acute, slightly emarginate and about twice as high as their base is long. Caudal concave, scaly at its base; second dorsal and anal nearly totally scaly. Pectorals conspicuously shorter than head, reaching to 7th lateral scale, provided with an axillary scale as also ventrals. Least height of caudal peduncle equal to or more than its length, about equal to postorbital part of head and about as long as half of head [1]). Silvery, back olivaceous, dorsals and caudal dusky. Length 166 mm. [Specimens of BLEEKER's collection in the Museum of Leiden and Amsterdam seen by us].

Habitat: Sumatra (Trussan, Padang, Priaman); Banka; Java (Pasuruan); Borneo (Sungi duri); Sangir Islands; Celebes (Makassar, Badjoa, Menado); Saleyer!; Timor; Ambon!; Buru!; Nusa Laut!; Ceram; Jobi. — Ceylon!, China (BLEEKER), Philippines.

13. **Mugil troscheli** Blkr.

Mugil Troschelii Bleeker, Nat. Tijdschr. Ned. Ind. XVI. 1858—1859, p. 277.
Mugil Troscheli Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 8ste Bijdr. visch-fauna Sumatra, p. 80.
Mugil troschelii Günther, Cat. Brit. Mus. III. 1859—1861, p. 448.
Mugil Troschellii (sic) Day, Fishes of India 4°, 1878—1888, p. 358.
Liza troscheli Jordan & Seale, Bull. Bur. Fish. XXVI. (1906) 1907, p. 11.
Liza troschelii Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harv. Coll. XXVI. Nr. 7, 1911, p. 256.

D^1. IV; D^2. I. 8—9; A. III. 9; L.l. 31—33; L.tr. 11—12.

Dorsal profile from first dorsal to neck slightly convex, from there to snout declivous in a nearly straight line. Height about equal to length of head, which is contained 3.4—3.8 in length, 4.3—4.7 in length with caudal. Eye 3.6—4 in length of head and about twice in postorbital part of head. Gelatinous eye-

1) In small specimens the height of caudal peduncle is relatively less.

lid only rudimentary developed. Interorbital space flat or nearly so, less than twice the diameter of the eye. Snout obtuse, equal to eye or somewhat shorter. Praeorbital scaly, slightly emarginate and indistinctly denticulated, the maxillary extending beyond it and conspicuous when mouth is closed. Lips thin, smooth. Origin of first dorsal conspicuously nearer to base of caudal than to end of snout, opposite to 11th or 12th lateral scale and separated by 19—20 praedorsal scales from snout. Dorsal spines about equal in height to second dorsal and anal. Origin of second dorsal opposite to 21st—23rd lateral scale. Anal with its anterior third before the origin of soft dorsal, its origin opposite to 19th—21st lateral scale. Both fins are entirely scaly. Pectorals shorter than head, reaching to 8th or 9th lateral scale. No axillary scale. Caudal emarginate. Least height of caudal peduncle about equal to its length and twice in length of head. Colour uniform. Back darkish green. Length more than 150 mm.

Habitat: Singapore; Pulu Weh!; Sumatra (Benkulen); Simalur!; Java (Batavia); Borneo! (Sungi duri); Celebes (Badjoa, Pompanua, Makassar!); Kangeang Island!; Flores (river Mbawa! and river Nargi!); Aru Islands!; North New Guinea (Kaiserin Augusta river!); South New Guinea (river Mimika). — East Africa, Madagascar, Seychelles, Ceylon, China, Japan, Formosa, Pescadores Islands, Philippines, Samoa, Pacific Islands.

In sea, brackish- and fresh-water.

14. **Mugil borneensis** Blkr.

Mugil borneënsis Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 201. — Ibid. XVI. 1858—1859, p. 278.
Mugil adustus Bleeker, Nat. Tijdschr. Ned. Ind. V. 1853, p. 503.
Mugil borneënsis Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13. Bijdr. visch-fauna Borneo, p. 55.
Mugil borneensis Günther, Cat. Brit. Mus. III. 1859—1861, p. 448.
Mugil borneensis Kner, Fische Novara-Exp. 1865—1867, p. 228.
Mugil borneensis Day, Fishes of India, 4°. 1878—1888, p. 357.
Liza borneensis Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harv. Coll. vol. XXVI. No. 7, 1911, p. 258.

D^1. IV; D^2. I. 8—9; A. III. 9; L.l. 32—34; L.tr. 10—11.

Rostro-dorsal profile anteriorly convex. Height 3.7 to nearly 4 times in length, $4^1/_2$—$4^3/_4$ in length with caudal. Head about 3.5 in length, about $4^1/_2$ in length with caudal. Eye about 4 times in length of head, twice in its postorbital part; gela-

tinous membrane wanting or very short. Interorbital space almost flat and nearly twice the diameter of eye. Snout obtuse, in adults about equal to diameter of eye. Praeorbital somewhat emarginate, conspicuously denticulate. Maxillary visible. Symphysial knob simple. Upper lip thin, its border ciliate. Origin of first dorsal separated by 18—21 praedorsal scales from snout, nearer to caudal than to end of snout, opposite to 11th lateral scale. Dorsal spines strong, longer than postorbital part of head, their height equal to that of second dorsal and anal. Both are nearly straight and nearly totally scaly. Origin of second dorsal opposite to 20th lateral scale and nearly totally behind the anal. Caudal emarginate. Pectorals shorter than head without snout, not reaching origin of first dorsal, without an axillary scale. Axillary scales on ventrals and at base of first dorsal well developed. Least height of caudal peduncle somewhat less than its length, nearly twice the length of the head. Silvery, olivaceous above. Fins blackish towards the margin. Anal generally with a whitish margin. Length 280 mm. [Specimens of BLEEKER's collection in the Museum of Leiden and Amsterdam seen by us].

Habitat: Singapore; Sumatra (Padang, Siboga); Nias!; Riouw; Bintang; Java (Patjitan); Borneo (Banjermasin, Sungi Duri, Kota Baru!); Celebes (Menado, Makassar); Timor; Ambon; Ceram!; Buru!; Obi major!; Saonek!. — Orissa, British India, Carolines, Tahiti, Tonga.

15. **Mugil caeruleomaculatus** Lac.

Mugil caeruleomaculatus Lacépède, Hist. nat. d. Poissons V. 1803, p. 385, 389 [1]).
Mugil caeruleo-maculatus Cuvier & Valenciennes, Hist. nat. Poiss. XI. 1836, p. 128.
Mugil coeruleo-maculatus Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 484.
Mugil coeruleomaculatus Bleeker, Nat. Tijdschr. Ned. Ind. XVI. 1858—1859, p. 279. — Act. Soc. Sc. Indo-Neerl. VIII. 1860, Negende Bijdrage vischfauna Sumatra, p. 5.
Mugil caeruleo-maculatus Günther, Cat. Brit. Mus. III. 1859—1861, p. 445.
Mugil caeruleo-maculatus Sauvage, Hist. nat. d. Poissons de Madagascar, 1891, p. 398.

D^1. IV; D^2. I. 8; A. III. 9; L.l. 36—38; L.tr. 12—13.

Dorso-rostral profile convex, declivous. Height decreasing

1) The species described by DAY as *coeruleo-maculatus* Lac. (Fish. of Brit. India II. 1889, p. 351), is not this species as f. i. the pectorals are much too short. *Liza coeruleomaculata* Jordan & Seale from Samoa is not this species.

with size of fish: 3.2—4.4 in length, 4.2—5.6 in length with caudal. Head 3.7—4.3 in length, 4.8—5.5 in length with caudal, still more relatively decreasing in size in exceptionally large specimens. Snout not depressed, convex, shorter than or equal to diameter of eye. Eye 3.5—4.8 in head, twice or less than twice in postorbital part of head, more or less than twice in the convex interorbital space. No gelatinous eyelid. Maxillary hidden when mouth is closed, covered by praeorbital, which is not emarginate and scarcely denticulated. Upper lip rather thick, smooth. Mandibles with a double symphysial knob. Origin of first dorsal slightly before or behind middle of distance between end of snout and base of caudal, opposite to 10th—13th lateral scale and behind about the 20th praedorsal scale; its height less than half length of head and much less than height of second dorsal, the origin of which is opposite to 22nd—23rd lateral scale and about to that of anal. Second dorsal and anal deeply concave and scaly, as also anterior part of caudal, which is forked. Pectorals falcate, longer than the head, reaching to behind origin of first dorsal, their axillary scale about $^1/_3$ of the length of the fin. Ventrals with an axillary scale of about half their length. Least height of caudal peduncle 1.1—1.5 in its length according to size of fish, 1.6—1.8 in length of head. Dark greenish or bluish above, silvery below. A blackish spot superiorly at the base of the pectorals. Length to 410 mm. [Specimens of *M. coeruleomaculatus* from BLEEKER's collection in the Museum of Leiden and Amsterdam seen by us].

Nom. indig.: Gadeh (Batavia); Belana putih (Bintang); Gorua (Menado).

Habitat: Singapore (KAROLI); Pulu Weh!; Sumatra (Telok betong, Tandjong, Trussan, Padang, Benkulen); Nias; Cocos Islands; Batu Islands; Riouw; Bintang; Java Sea!; Java (Batavia, Prigi); Celebes (Makassar, Bonthain, Badjoa, Pompanua, Menado); Flores!; Timor; Obi; Ambon; Buru; Ceram; Ternate; Waigeu!; New Guinea. — Madagascar, Zanzibar, Seychelles, Mauritius, Bourbon, Bangkok, Philippines.

In sea and fresh water.

Note. This species is also quoted by JORDAN & SEALE and KENDALL & GOLDSBOROUGH from Carolines-, Tonga-, Fiji-Islands, Samoa and Guam, but the fish named by JORDAN & SEALE as *coeruleomaculatus* Lac. is not this species but probably *M. seheli* Forsk.

16. Mugil seheli Forsk.

Mugil seheli Forskål, Descr. Anim. 1775, p. 73.
? *Mugil axillaris* Cuvier & Valenciennes, Hist. nat. d. Poissons XI. 1836, p. 139.
? *Mugil parsia* Bleeker, Nat. Tijdschr. Ned. Ind. III. 1852, p. 166 (nec Buchanan? nec Cuvier & Valenciennes? [1]).
Mugil cylindricus Bleeker, Nat. Tijdschr. Ned. Ind. IV. 1853, p. 266.
Mugil borbonicus Bleeker, ibid. XVI. 1858—1859, p. 279 (nec C.V. nec Cant.); XVIII. 1859, p. 375 (nec C.V., nec Cant.).
Mugil axillaris Bleeker, ibid. XVI. 1858—1859, p. 280.
Mugil axillaris Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Negende Bijdr. vischfauna Sumatra, p. 3.
Mugil axillaris Günther, Cat. Brit. Mus. III. 1859—1861, p. 444.
Mugil bleekeri Günther, ibid. p. 445.
Mugil decem-radiatus Günther, ibid. p. 452, founded on *M. parsia* Blkr. which is according to Bleeker himself a synonym of *M. axillaris*.
Mugil seheli Klunzinger, Abh. zool.-bot. Ges. Wien XX. 1870, p. 827. — Fische d. Rothen Meeres I. 1884, p. 132.
Mugil axillaris Günther, Südsee-Fische, Heft VI. 1881, p. 216 (Description, not figure).
Mugil seheli Day, Fishes of India, 4°. 1878—1888, p. 355.
Mugil axillaris Sauvage, Hist. nat. d. Poissons de Madagascar, 1891, p. 397.
Mugil Bleekeri? Max Weber, Zool. Ergebn. Reise N. O. Indien, Heft 2, 1894, p. 416.
Mugil axillaris Seale, Occ. Papers B. P. Bish. Mus. I. (1900) 1901, p. 66.
Mugil seheli Max Weber, Siboga-Exp. Fische, 1913, p. 140.
Mugil bleekeri de Beaufort, Bijdragen tot de Dierkunde, Afl. 19, Amsterdam, 1913, p. 107.

D[1]. IV; D[2]. I. 8; A. III. 9; P. 2.16—17; V. 1.5; L.l. 38—40; L. tr. 14—15.

Profile from first dorsal to snout slightly convex. Height relatively decreasing with size of fish 3.2—4 in length, 4.1—5 in length with caudal, about equal to length of head. Eye 3.4 to 4 in head, 1.7 to more than twice in postorbital part of head; without gelatinous eyelid. Interorbital space more or less convex, 2—2.4 in length of head, more or less than twice the diameter of the eye. Praeorbital scarcely emarginate and indistinctly denticulated, covering the maxillary, which is hidden when mouth is closed. Upper lip more or less fleshy, smooth. Mandible with a double symphysial knob. Snout obtuse, not depressed, convex, somewhat shorter than eye. Origin of first dorsal about midway between end of snout and base of caudal, in large specimens nearer to end of snout, it is opposite to 11th or 12th scale and separated from snout by 22 or 23, exceptionnally only by 20—21 scales. Height of dorsal

1) Bleeker himself (Act. Soc. Sc. Indo-Neerl. VIII. 1860, Negende Bijdrage vischfauna Sumatra p. 3) quotes it under the synonymy of *M. axillaris*.

spines about equal to postorbital part of head, lower than second dorsal, which is concave, as also anal. Both are opposite to each other or nearly so and opposite to 23rd or 24th lateral scale. Both are scaly as also caudal, which is deeply emarginate. Pectorals slightly shorter than head, reaching to origin of first dorsal, with an axillary scale about $^1/_3$ or more of the length of the pectoral. Axillary scale of ventrals about equal to half the length of that fin. Least height of caudal peduncle 1.1—1.4 in its length and more or less than twice in length of head. Teeth are wanting. Greenish or bluish above, silvery below, pectorals yellowish with a black spot in the axil. Length reaching to 465 mm. [Specimens of *M axillaris* C.V., *cylindricus* C.V., *borbonicus* Blkr. from BLEEKER's collection in the Museum of Leiden and Amsterdam seen by us].

Nom. indig.: Gadeh, Ikan Belanak (Batavia); Gorua (Batjan).

Habitat: Singapore; Sumatra (Benkulen); Nias!; Banka; Java Sea!; Java (Batavia!, Samarang, Surabaya, Karangbollong); Nusa Kembangan!; Madura; Bali; Sumba!; Kangeang Island!; Saleyer!; Celebes (Menado, Makassar!); Halmaheira!; Ternate; Batjan; Buru; Ambon!; Timor!; Aru!; Waigeu; Saonek!; New Guinea. — From Red Sea, East coast of Africa, Madagascar, Mauritius, Seychelles, Bourbon through seas of India, China (Amoy, Shanghai, [BLEEKER]), Marianas, Fidji-?, Samoa Islands?.

In fresh and brackish water.

17. Mugil cephalus L.

Mugil cephalus Linné, Syst. nat. edit. X*a*. 1758, p. 316.
Mugil öur Forskål, Descr. anim. 1775, p. 74.
Mugil cephalus Hamilton Buchanan, Gangetic Fish. 1822, p. 119.
Mugil cephalotus Cuvier & Valenciennes, Hist. nat. d. Poissons XI. 1836, p. 110.
Mugil öur Rüppell, Neue Wirbelthiere, 1835—1840, p. 131.
Mugil cephalotus Eydoux & Souleyet, Voy. de "la Bonite", 1841, p. 175.
Mugil japonicus Temminck & Schlegel, Fauna Japonica 1845, p. 134.
? *Mugil cephalotus* Cuvier & Valenciennes, Bleeker, Nat. & Geneesk. Arch. Ned. Ind. II (3) 1845, p. 514. — Verh. Bat. Gen. XXII. 1849, Bijdr. ichth. fauna Madura p. 5. — Ibid. XXIII. 1850, Bijdr. ichth. fauna Midden en Oost-Java, p. 9.
Mugil macrolepidotus Richardson, Ichth. of the seas of China & Japan, 1846, p. 249.
Mugil japonicus Bleeker, Verh. Bat. Gen. XXV. 1853, Nalezingen ichth. Japan, p. 41.
Mugil cephalotus C.V.? Cant. Bleeker, Nat. Tijdschr. Ned. Ind. XVI. 1858—1859, p. 277.
Mugil dobula Günther, Cat. Brit. Mus. III. 1859—1861, p. 420.
Mugil cephalotus Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13de Bijdr. Vischfauna Borneo, p. 51.
Mugil cephalotus Kner, Fische Novara-Exp. I. 1865—1867, p. 224.

Mugil cephalotus Günther. Ann. Mag. Nat. Hist. (3) XX. 1867, p. 64 (name only).
Mugil oeur Klunzinger, Abhandl. zool.-bot. Ges. Wien XX. 1870, p. 829.
Mugil cephalotus Bleeker, Ned. Tijdschr. Dierk. IV. 1873, p. 100. — Ibid. p. 143.
Mugil japonicus Bleeker, ibid. p. 143.
Mugil cephalotus Bleeker, Poiss. de Madagascar 1875, p. 45.
Mugil oeur Day, Fishes of India 4°. 1878—1888, p. 353.
Mugil cephalotus Bleeker, Verh. Akad. Amsterdam XVIII. 1879, Poiss. de Chine, p. 2.
Mugil japonicus Bleeker, ibid. Poiss. du Japon, p. 17.
Mugil cephalotus Günther, Challenger Exp. VI. Shore-Fishes 1880, p. 33.
Mugil dobula Günther, Fische Südsee II. Journ. Mus. Godeffr. 1881, p. 214.
Mugil oeur Klunzinger, Fische d. roth. Meeres 1884, p. 132.
Mugil öur Steindachner & Döderlein, Fische Japan's, IV. Denkschr. Akad. Wien LIII. 1887, p. 266.
Mugil cephalotus Nyström, Bihang K. Sv. Vet. Akad. Handl. XIII. Afd. IV. No. 4, 1887, p. 38.
Mugil oeur Day, Fishes of Brit. India II. 1889, p. 348.
Mugil cephalotus Sauvage, Poiss. Madagascar, 1891, p. 402.
Mugil cephalus Evermann & Jenkins, Proc. U. S. Nat. Mus. XIV. (1891) 1892, p. 136.
Mugil cephalus Jordan & Evermann, Fish. North & Middle America I. 1896, p. 811.
Mugil oeur Rutter, Proc. Acad. Nat. Sc. Philad. 1897, p. 70.
Mugil hypselosoma Ogilby, Proc. Linn. Soc. N. S. Wales XXII. 1897, p. 74.
Mugil dobula Steindachner, Denkschr. Akad. Wien, LXX. 1900, p. 501.
Mugil our Jordan & Snyder, Proc. U. S. Nat. Mus. XXIII. 1901, p. 744.
Mugil oeur Jordan & Evermann, ibid. XXV. 1902, p. 332.
Mugil cephalus Jenkins, Bull. U. S. Fish Comm. XXII. 1902 (1904), p. 438.
Mugil cephalus Jordan & Seale, Proc. U. S. Nat. Mus. Wash. XXIX. 1905, p. 521.
Mugil cephalus Jordan & Evermann, Bull. U. S. Fish Comm. XXIII. (1903) 1905, p. 139.
Mugil cephalus Tanaka, Fishes of Japan III. 1911, p. 50.
Mugil cephalus Mc Culloch, Check-list of fish of N. S. Wales II. 1919, p. 38.

D^1. IV; D^2. I. 8; A. III. 8; P. 2.15—16; V. 1.5; L.l. 37—40; L.tr. 14—15.

Rostro-dorsal profile nearly horizontal, lower profile strongly curved. Height, which is conspicuously less than length of head, somewhat more or less than 5 (in large specimens $5^2/_3$ to nearly 6) in total length, $4^1/_2$—$4^3/_4$ in length without caudal. Eye more or less than 4 in head, twice or somewhat more in postorbital part of head; gelatinous eyelid broadly developed anteriorly and posteriorly reaching to pupil; interorbital space nearly flat, conspicuously broader than eye. Snout shorter than eye, somewhat pointed but broadly rounded, when seen from above; its frontborder formed by the upperlip, which is rather thin. Free border of both lips with conspicuous yellowish ciliae (teeth). Maxillary not visible when mouth is closed or only a narrow stripe of its posterior part. Praeorbital scaly, neither notched nor bent, its lower and posterior border ser-

rated. Mandible with a nearly single symphysial knob; mandibulary angle more acute in small, more obtuse in older individuals. Origin of first dorsal midway between end of snout and base of caudal or somewhat nearer to firstnamed. Its spine equal to half length of head or somewhat longer, slightly lower than second dorsal and anal, which both are concave. About 20—22 praedorsal scales. Origin of first dorsal spine opposite to 11th—12th, that of second dorsal opposite to 23rd—25th lateral scale, that of anal somewhat before second dorsal. Pectorals acute, equal to or shorter than head without snout, reaching to about 9th or 10th lateral scale. Caudal deeply emarginate, its upper lobe the longer. A short axillary scale above pectorals and ventrals. Least height of caudal peduncle $2^1/_4$—$2^1/_3$ in length of head. Greyish above, silvery below, a dark line along each row of scales in the upper half of the body, getting less conspicuous and shorter in the lower half. Second dorsal, anal, caudal and ventrals with a dusky margin; pectorals with the outer third blackish, with a narrow whitish margin and a dark crossband at its base. Length 430 mm.

Habitat: Java (KNER); Borneo!; New Guinea (MACLEAY). — Red Sea, Sokotra, Madagascar, Mauritius, Bourbon, Balutchistan, British India (river Ganges), China, Japan, Formosa, Philippines, Australia, Tasmania, New Zealand, Lord Howe Island, Norfolk Island, Solomon Islands, Nukahiva, Society Islands, Sandwich Islands, Mediterranean, Atlantic coast of United States, Panama, Southern California, Pacific Coast of Monterey to Chili.

Note. BLEEKER mentions this species under the name of *Mugil cephalotus* C.V. from Java (Samarang, Surabaya, Besuki, Batavia) and Madura, but only in lists of fishes published in 1845, 1849 and 1850. We are not sure, that these determinations were correct, as in later lists this species is mentioned only from Madagascar and China, but not more from the Archipelago. We can't make out if KNER (l.s.c.) really disposed of specimens of this species from Java or if he mentions it from Java in his article on the authority of BLEEKER.

It is an extraordinary fact, that *M. cephalus* L., known from so many localities in tropical and temperate seas all over the world, is very rare in the Archipelago and with any certainty only represented in New Guinea and Borneo. Lastnamed locality is based on a specimen examined by us and preserved in the Leiden Museum under N°. 1671. On the label is written

„Mugil" and underneath „M.—Borneo". By „M." is very probably indicated S. MÜLLER, who collected in Borneo. — *M. cephalotus* of Cantor (Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1077) is without question not *M. cephalotus* C.V., but probably *M. planiceps* C.V. as already stated by GÜNTHER (Cat. Brit. Mus. III. 1859—1861 p. 419 & 428).

18. Mugil crenilabis Forsk.

Mugil crenilabis Forskål, Descript. Anim. 1775. p. 73.
Mugil cirrhostomus (Forst.) Bloch Schneider, Syst. ichth. 1801, p. 121.
Mugil crenilabis Cuvier & Valenciennes, Hist. nat. Poiss. XI. 1836, p. 123.
? *Mugil fasciatus* Cuvier & Valenciennes, ibid. p. 125.
Mugil crenilabis Rüppell, Neue Wirbelthiere, Fische 1835—1840, p. 132.
Mugil cirrhostomus Forster, Descr. anim. curante Lichtenstein, 1844, p. 198.
Mugil crenilabis Günther, Cat. Brit. Mus. III. 1859—1861, p. 458.
Mugil rüppellii Günther, ibid. p. 458.
Mugil crenilabris Kner, Fische Novara-Exp. 1865—1867, p. 228.
Mugil crenilabis Klunzinger, Abhandl. zool.-bot. Gesellsch. Wien XX. 1870, p. 826.
Mugil crenilabris Günther, Fische Südsee, II. Journ. Mus. Godeffr. 1881, p. 219.
Mugil crenilabris Day, Fishes of India 4°. 1878—1888, p. 355 & p. 800.
Mugil crenilabis Klunzinger, Fische d. Roth. Meeres I. 1884, p. 132.
Querimana crenilabis Jordan & Seale, Bull. Bur. Fish. vol. XXV. 1906, p. 218.
Liza crenilabis Kendall & Goldsborough, Mem. Mus. Comp. Zoöl. Harv. Coll. vol. XXVI. No. 7, 1911, p. 258.
Mugil crenilabis de Beaufort, Bijdr. tot de Dierk. Afl. 19, Amsterdam, 1913, p. 108.

D^1. IV; D^2. I. 8; A. III. 9; P. 2.15; V. 1.5; L.l. 39—42; L.tr. 13.

Rostro-dorsal profile nearly horizontal. Height equal to or somewhat less than length of head, which goes $4^1/_2$—5 times in total length. Eye without gelatinous membrane, 3—$3^1/_2$ in head. Interorbital space nearly flat, more than twice in length of head and about equal to its postorbital part. Praeorbital oblique, nearly straight, its lower border with a shallow emargination, its hindborder truncate and serrated. Maxillary hidden. Upperlip very thick, forming the frontborder of the snout, its lower fourth with about 4 series of soft papillae, the inferior of which are branched at their extremities; it is deeply deflected to the rather thick lower lip, which is thickly studded with papillae but which are wanting in the central part of the lower lip. Origin of first dorsal, which is separated by about 20 scales from end of snout, is nearer to base of caudal than to end of snout and opposite to about 12th or 13th scale of lateral line. Dorsal spines rather weak, the first about equal to postorbital part of head, lower than second dorsal and anal, which

are emarginate. Origin of second dorsal opposite to 24th—25th lateral scale and somewhat behind that of anal. Pectorals slightly shorter than head, reaching vertical through origin of first dorsal. Caudal deeply emarginate, the lobes pointed. No enlarged axillary scales. Greenish above, dull withe on the sides and below. Base of pectorals superiorly with a small blackish spot. Length 500 mm.

Habitat: Saonek!. — Red sea (Sokotra), Madagascar, Andamans, Nicobars, Guam, Marshall Islands, Kingsmill Islands, New Ireland, Ponapé, Tahiti, Tanna, Society Islands, Paumotu Islands, Christmas Island, Japan.

19. Mugil macrochilus Blkr.

Mugil sp. Jenyns, Zool. Beagle, Fishes 1842, p. 81 & 82 (secundum Bleeker l.i.c.).
Mugil macrocheilos Bleeker, Nat. Tijdschr. Ned. Ind. VII. 1854, p. 43.
Mugil macrocheilos Bleeker, ibid. XVI. 1858—1859, p. 280.
Mugil macrochilus Günther, Cat. Brit. Mus. III. 1859—1861, p. 458.

D^1. IV; D^2. I. 7—8; A. 3.9; P. 2.16; V. 1.5; L.l. 41—42.

Rostro-dorsal profile slightly convex. Height $5^1/_3$ to $5^1/_4$ in total length, head somewhat obtuse, about $5^2/_5$ in total length. Eyes nearly without gelatinous eyelid, nearly 4 times in head, nearly twice in its postorbital part and about half of interorbital space. Snout obtuse, projecting beyond the mouth and about as long as the eye. Intermaxillaries much protractile; maxillaries nearly entirely hidden, when mouth is closed. Praeorbital not emarginate, slightly denticulate posteriorly at its inferior and at its truncate posterior border. Upperlip very fleshy and broad, its inferior border with a single series of very conspicuous obtuse papillae, more or less fringed or denticulated; lower lip with similar papillae. Symphysial knob single, quadrate. Spinous dorsal much lower than height of body; second dorsal slightly lower, scaly, acute, emarginate, as also anal, which is higher and commences in the same vertical, or nearly so, as second dorsal. Pectorals acute, as long as head with elongate axillary scales. Caudal deeply emarginate, the lobes acute, $4^1/_2$ times in total length. Greenish above, silvery below; hindborder of caudal brownish, a blackish spot superiorly at the base of the pectorals. Length 310 mm. [After Bleeker, not seen by us].

Habitat: Cocos Islands [1]).

1) As the single known specimen, described by Bleeker, was collected at the Cocos (Keeling) Islands, Java is erroneously named by Günther.

20. Mugil heterochilus Blkr.

Mugil heterocheilos Bleeker, Nat. Tijdschr. Ned. Indië IX. 1855, p. 198; ibid. XVI. 1858—1859, p. 280.
Mugil heterocheilos Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 13de Bijdr. Vischfauna Celebes, p. 57.
Mugil heterochilus Günther, Cat. Brit. Mus. III. 1859—1861, p. 457.
Mugil heterochilus Max Weber, Jenaische Denkschr. VIII. 1895, p. 108.
Mugil heterocheilus Max Weber, Siboga-Exp. Fische 1913, p. 141.

D^1. IV; D^2. I. 8; A. III. 9; L.l. 40—41; L.tr. 12—13.

Rostro-dorsal profile horizontal, anteriorly slightly convex. Height somewhat more than length of head, 5 to $5^1/_3$ times in length with caudal. Head about 5 to $5^3/_4$ times in length with caudal[1]). Eye 3 or more in length of head, nearly $1^1/_2$ in its postorbital part; no gelatinous membrane. Interorbital space only slightly convex, nearly as broad as half length of head. Snout slightly convex, shorter than eye. Praeorbital somewhat emarginate, squamate, only its posterior border finely denticulate. Maxillary invisible or nearly so when mouth is closed. Upper lip very thick, high, forming frontborder of snout, inferiorly with an indistinct series of obtuse low papillae which may be wanting[2]); lower lips not papillate, emarginate at symphysis. Symphysial knob double. Origin of first dorsal separated from snout by 20 praedorsal scales, about midway between end of snout and base of caudal or somewhat nearer to caudal, opposite to 12th—13th lateral scale. Dorsal spines rather weak, longer than postorbital part of head, but lower than second dorsal and anal, which are concave and scaly. Origin of second dorsal opposite to 24th—25th lateral scale and somewhat behind origin of anal. Caudal emarginate, its base scaly. Pectorals equal to or somewhat longer (in small specimens shorter) than head, not reaching origin of first dorsal; an axillary scale on pectorals is wanting or small, but present on axil of ventrals and at base of first dorsal. Least height of caudal peduncle less than $1^1/_2$ times in its length, nearly twice the length of head. Silvery, olivaceous above, generally a dark spot superiorly at base of pectorals. Fins yellowish. Length 228 mm.

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1) The valuation of height and head is taken from Bleeker's description as we dispose of small specimens only, less than 100 mm.

2) Their presence depends perhaps on sex or on season of rut.

Habitat: Java (Karangbollong, Prigi); Celebes (Klabat diatas, Dongala!); Batjan; Ceram; Ambon!.

In sea and fresh water.

21. **Mugil labiosus** C.V. [Fig. 67, p. 231].

Mugil labiosus Cuvier & Valenciennes, Hist. nat. Poiss. XI. 1836, p. 125.
Mugil labiosus Bleeker, Nat. Tijdschr. Ned. Ind. VI. 1854, p. 213.
Mugil labiosus Bleeker, ibid. XVI. 1858—1859, p. 278.
Mugil labiosus Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, 9de Bijdr. Vischfauna Sumatra, p. 6.
Mugil labiosus Günther, Cat. Brit. Mus. III. 1859—1861, p. 454.
Mugil labiosus Klunzinger, Abhandl. zool.-bot. Gesellsch. Wien, XX. 1870, p. 830. — Fische Roth. Meeres I. 1884, p. 133.
Mugil labiosus Day, Fishes of India 4°. 1878—1888, p. 357.
Mugil labiosus Max Weber, Siboga-Exp. Fische 1913, p. 140.

D^1. IV; D^2. I. 7—8; A. III. 9; P. 2.15; V. 1.5; L.l. 34—36; L. tr. 11—12.

Rostro-dorsal profile slightly convex or rather steep. Height more than head, which goes less than 4—$4^1/_2$ times in length and less than $5^1/_2$ times in length with caudal. Eye without gelatinous eyelid, 3 to $3^1/_2$ in head and twice in its postorbital part. Interorbital space nearly flat and nearly half length of head. Praeorbital bone bent and emarginate, its end broadened, truncate and finely serrated, getting more straight and obliquely descending and less notched in old specimens. Extremity of maxillary visible behind praeorbital, getting hidden when mouth is closed in very aged individuals. Also the lips change with age in fullgrown and medium sized individuals, the upper lip is very thick and high, forming the frontborder of the blunt snout. Near its lower margin a shallow rim or groove is more or less conspicuous, provided with generally one row of more or less pointed papillae, decreasing with age. Lower lip without papillae, its symphysial knob rather high and about double. Least height of caudal peduncle about twice in head. Origin of spinous dorsal, separated by about 20 scales from snout, about midway between end of snout and base of caudal or nearer to caudal, opposite to 11th—12th lateral scale. Its spines of moderate strength, longer than postorbital part of head; somewhat lower than second dorsal and anal, which both are emarginate and scaly. Origin of second dorsal opposite to 23rd or 24th lateral scale and to posterior half of anal. Pectorals as long as or slightly longer than head, reaching vertical through

origin of first dorsal or nearly so. Caudal emarginate, scaly at its base. Axillary scales short. Olivaceous above, silvery on sides and below. Length 230 mm.

Habitat: Simalur!; Sumatra (Benkulen, Trussan); Timor; Ambon!; Biaru!; Salibabu!. — Red Sea, Andamans.

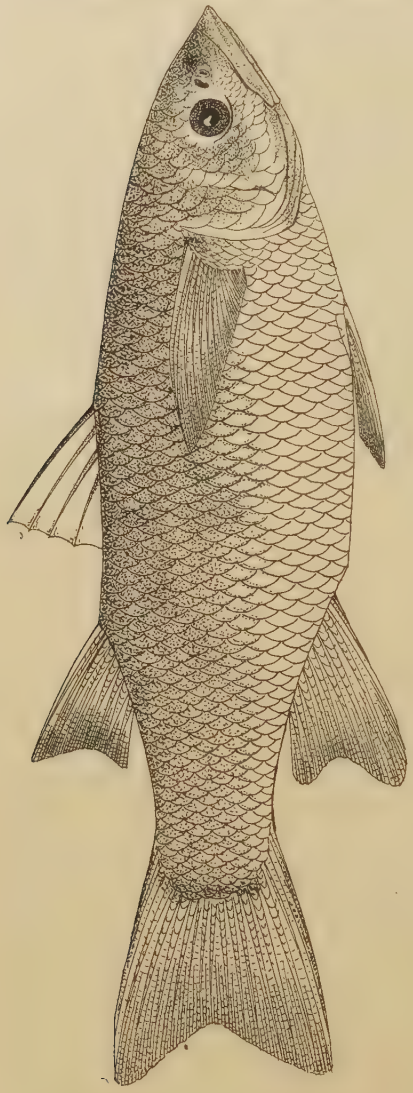

Fig. 68. *Cestraeus goldiei* (Macl.)

2. Cestraeus
Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poissons XI. 1836, p. 156).
Agonostoma Günther, Cat. Brit. Mus. III. 1859—1861, p. 461 (p. p.) [nec *Agonostomus* Bennett].
Aeschrichthys Macleay, Proc. Linn. Soc. New South Wales VIII. (1883) 1884, p. 5 & 270.

Mouth not transverse but longitudinally cleft and extending on sides of snout to below eye. Upperlip thick. Mandible included, its margin not sharp but rounded by the fleshy lower lip, on each side provided with a cushion-like oval prominence with numerous closely set membranaceous lamellae. A narrow band of small true teeth in intermaxillaries, which may be also present in one series in the mandible of young specimens. Vomer with or without a roundish patch of teeth on both sides. Other exterior characters as in *Mugil*.

Living in rivers up to 350 M. above sea in the indo-australian Archipelago, New Guinea, Philippines, New Hebrides, New Caledonia, (China?).

Key to the indo-australian species of Cestraeus.

1. No teeth on vomer. Origin of first dorsal far behind end of pectorals, which reach to 10th lateral scale. End of snout blunt . . . . . *C. plicatilis* p. 261.
2. Two patches of teeth on vomer. End of snout pointed. Pectorals ending below origin of first dorsal, opposite to 12th or 13th lateral scale.
   a. Origin of second dorsal opposite to 22nd—24th, that of anal opposite to 20th—22nd lateral scale. *C. goldiei* p. 262.
   b. Origin of second dorsal opposite to 27th—28th, that of anal opposite to 25th lateral scale . . . . *C. oxyrhynchus* p. 263.

1. Cestraeus plicatilis C.V.

Cestraeus plicatilis Cuvier & Valenciennes, Hist. nat. Poissons XI. 1836, p. 157.
Cestraeus plicatilis Bleeker, Journ. Ind. Arch. III. (1848) 1849, p. 67. — Nat. Tijdschr. Ned. Ind. II. 1851, p. 213.
Agonostoma plicatile Günther, Cat. Brit. Mus. III. 1859—1861, p. 461.
Agonostoma plicatile Bleeker, Ned. Tijdschr. Dierk. IV. (1871) 1872, p. 143.
Agonostoma plicatile Günther, Fische der Südsee II. 1876, p. 219.
Cestraeus plicatilis M. Weber & de Beaufort, in Sarasin & Roux, Nova Caledonia, Zoologie II. Livr. 1, N°. 2, 1915, p. 27.

D^1. IV; D^2. II. 7; A. III. 8—9; P. ca. 20; V. 1.5; L.l. ca. 45; L. tr. 14.

Elongate, rostro-dorsal profile convex. Height nearly 4, about $4^3/_4$ in length with caudal; head bluntly pointed, nearly $4^2/_5$, about $5^1/_2$ in length with caudal. Eye more than 4 times in head, twice or more in convex interorbital space, conspicuously shorter than snout and about one third shorter than postorbital part of head. Intermaxillaries, covered by a rather thick lip, reaching to vertical through anterior margin of pupil. Mandible somewhat included. Only the intermaxillaries with a row of small teeth. Origin of first dorsal midway between end of snout and base of caudal, separated by about 23 scales from end of triangular patch of small scales behind upperlip and opposite to about 14th lateral scale. Origin of second dorsal opposite to about 23th lateral scale and about 2 scales behind that of anal, the base of which is longer. Both fins are slightly emarginate as also caudal. Pectorals shorter than head, their end is separated by 4—5 scales from vertical through origin of first dorsal. Least height of caudal peduncle about twice in length of head and nearly one third shorter than its length. Dark-greenish above, sides grayish, white below. Fins dark distally. Length 325 mm.

Habitat: Celebes [1]) (Menado). — New Caledonia!, New Hebrides, (China? after BLEEKER).

In fresh and brackish water.

2. **Cestraeus goldiei** (Macl.) [Figs. 68, 69, p. 260, 262].

Aeschrichthys Goldiei Macleay, Proc. Linn. Soc. New South Wales VIII. (1883) 1884, p. 5 & 270.
Aeschrichthys goldiei Jordan & Richardson, Bull. Bur. Fish. Wash. 1908, p. 244.
Aeschrichthys Goldiei M. Weber & de Beaufort, Versl. Akad. Amsterdam 1912, p. 135.
Cestraeus goldiei M. Weber & de Beaufort, in Sarasin & Roux, Nova Caledonia, Zoologie II. Livr. 1, N°. 2, 1915, p. 26.

D^1. IV; D^2. I. 8; A. III. 9; P. 1. 15—16; V. 1.5; L.l. 36—41; L. tr. 13—14.

Oblong, rostro-dorsal profile convex. Height 3.7—3.8, 4—4.8 in length with caudal; head nearly 4—4.4, 4.7—5.5 in length with caudal. Eye 6.4 to 7 times in head $2^1/_2$ to nearly 4 times in the strongly convex interorbital space, about 3 times in postorbital part of head and about $2^1/_2$ times in length of pointed prominent snout. Intermaxillaries with a thick, fleshy lip, reaching to below or behind pupil. Mandible deeply included. Two series of teeth on intermaxillaries and a patch of teeth on each side of vomer. Origin of first dorsal nearer to end of snout than to base of caudal, separated by 22 to 23 scales from patch of small scales behind upperlip and opposite to 11th or 12th lateral scale. Origin of second dorsal opposite to 22nd or 24th lateral scale and 2 scales behind that of anal, the base of which is longer. Both fins are deeply emarginate as also caudal. Pectorals about as long as head, reaching to vertical through origin of first dorsal or surpassing it. Least height of caudal peduncle somewhat shorter than its length and equal to head

Fig. 69. *Cestraeus goldiei* (Macl.) n. s.
Ventral surface of head to show the mandible included in the upper jaws with their thickened lips.

1) In the collection of BLEEKER in the Leiden Museum are 3 specimens of this species from the Archipelago but without indication of the locality.

without its postorbital part. Grayish above, whitish below. Length 410 mm.

Habitat: Timor (river Noil Bidjeli 350 M. above sea!); New Guinea (river Goldie!). — Philippines (JORDAN & RICHARDSON). In rivers.

Note. This diagnosis is drawn after our specimens from Timor, after a specimen in BLEEKER's collection in the Leiden Museum, found by Miss Dr. C. POPTA in a bottle together with two specimens of *C. oxyrhynchus* C.V. and accordingly labelled and after a cotype of MACLEAY of 410 mm. length, which we received from the Australian Museum through the kind intervention of Mr. MC CULLOCH. Our thanks are due to the Trustees and the Director of the Australian Museum.

3. Cestraeus oxyrhynchus C.V.

Cestraeus oxyrhyncus Cuvier & Valenciennes, Hist. Nat. Poiss. XI. 1836, p. 162.
Cestraeus oxyrhynchos Bleeker, Nat. Tijdschr. Ned. Indië IX. 1855, p. 307.
Cestraeus oxyrhynchus Bleeker, Act. Soc. Sc. Indo-Neerl. VIII. 1860, Negende Bijdr. Vischfauna Sumatra, p. 9.
Agonostoma oxyrhynchum Günther, Cat. Brit. Mus. III. 1859—1861, p. 461.
Agonostoma oxyrhynchus Bleeker, Ned. Tijdschr. Dierk. II. 1865, p. 191. — Ibid. p. 291.

D^1. IV; D^2. I. 8; A. III, 9—10; P. 2.16—17; V. 1.5; L.l. 42—45; L. tr. 14.

Elongate; rostro-dorsal profile convex. Height 3.7—4 in length; 4.8—5 in length with caudal; head slightly shorter than height. Eye about $4^1/_2$ times in head, about twice in strongly convex interorbital space and in postorbital part of head and about 1.5 times in the pointed snout. Intermaxillaries covered by thick, fleshy lips, reaching to about middle of eye. Mandible included. Teeth in intermaxillaries anteriorly in two, posteriorly irregularly in three series. A roundish patch of teeth on each side of vomer. Origin of first dorsal nearer to end of snout than to base of caudal, separated by 23 to 24 scales from patch of small scales behind upperlip and opposite to 13th lateral scale. Origin of second dorsal opposite to 27th or 28th scale of lateral line and two or three scales behind that of anal, its base and height longer than those of second dorsal; both fins are strongly emarginate as also caudal. Pectorals less than one eye-diameter shorter than head, reaching to

vertical through origin of first dorsal or nearly so. Olivaceous above, silvery below. Length 390 mm.

Habitat: Sumatra (Benkulen, Padang); Sumbawa [1]); Celebes (Sawangan, Menado, Klabat di atas); Buton [1]); Ambon; Ceram; Batjan.

Note. This diagnosis is drawn after the type of *C. oxyrhynchus* C.V. in the Paris Museum and after 2 specimens in BLEEKER's collection in the Leiden Museum. We have to thank Dr. J. PELLEGRIN and Miss Dr. C. POPTA for their valuable informations about these specimens.

3. **Myxus** Günther.

(GÜNTHER, Cat. Brit. Mus. III. 1859—1861, p. 466).

Snout pointed. Mouth not transverse but longitudinally cleft on sides of snout but not reaching orbit. Upperlip not fleshy, anterior margin of mandible sharp, lower lip thin without a lamellated apparatus. Well developed teeth in a single row on intermaxillaries, sometimes also on mandible; minute teeth on vomer and palatines. Other exterior characters not differing from those of *Mugil* and *Cestraeus*.

Living along the coast and in fresh water of Eastern and Western Australia, Tasmania, Lord Howe Island, Norfolk Island, Cook Island, Makatea.

Of this australian and pacific genus

Myxus cf. *elongatus* Gthr.

is quoted by E. VON MARTENS (Preuss. Exp. Ost-Asien, 1876, p. 310) from Singapore.

We suppose that this is erroneus, though it may be possible, that *Myxus elongatus* Gthr. may be found in New Guinea or the Aru Islands.

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1) According to Miss Dr. C. POPTA, after material from the Elbert-expedition. She has been so kind to give us also valuable information about the specimens of BLEEKER in the Leiden Museum. The seven examples are contained in two bottles. By examining them one example of 220 mm. length showed the characters of *C. goldiei*, as remarked on page 263.

APPENDIX.

In their valuable "Notes on a Collection of Fishes from Java, made by Owen Bryant and William Palmer in 1909, with description of a new species" Proc. U. S. Nat. Museum Vol. 42, 1912, p. 596, BARTON A. BEAN & ALFRED C. WEED give the following description:

Agonostomus bryanti Bean and Weed, new species

"Two specimens, 51 mm. long. Pelaboean Ratoe, Wynkoop's Bay, October, 1909.

"We are informed that there are many small mountain streams flowing into the bay and it is probable that these fish were taken from one of these.

"Head, $3^1/_2$; depth, 4; snout, $5^1/_2$; eye, $3^3/_7$; D. V—I, 8; A. III, 8; scales 26—29 in horizontal series, the specimens being in such condition that it is practically impossible to make an accurate count. Teeth in a villiform patch in each jaw, the outer row considerably enlarged. The teeth in the inner rows are so small that they can not be detected by the use of a dissecting needle but are plainly visible under the microscope. Looking directly down on their ends they look like minute papillae. Papillae of similar appearance are visible in all parts of the roof of the mouth of the cotype, being especially crowded on the head of the vomer. The teeth of the outer row are strong, conical abruptly recurved and, perhaps, slightly flattened at the tip. In *Agonostomus monticola* the teeth in the jaws are all recurved, with the tip flattened, spoon-shaped, bicuspid or tricuspid. A careful inspection will show all types in the same jaw.

"Mouth very small, oblique, the lower jaw strongly projecting. The maxillary does not reach front of eye.

"Caudal rounded; soft dorsal opposite anal and similar to it but with slightly shorter base.

"Scales ctenoid, a single row of teeth on the edge of each. In *Agonostomus monticola* there are from three to six rows of fine teeth on the outer edge of each scale. An unidentified specimen of *Joturus* has the entire exposed surface of the scale closely covered with fairly strong teeth.

"This species differs from all other species of *Agonostomus* of which we can find any description in the small number of

scales. The mouth, also, is smaller and directed more upward than in others. The teeth are apparently larger than *A. monticola*.

"Color in alcohol uniform pale brownish.

"The dorsal fins were apparently black in life."

In their last sentence the authors themself draw already the attention on the characters in which this species, of which they give a figure, differs from all other species of *Agonostoma*.

We doubt the correctness, that it is an *Agonostoma*, as in that genus, at least in the indo-pacific species, the upper lip is thick, the mandible covered with a thick, callous, trenchant lower lip, the mouth is nearly horizontal, the lower jaw is never projecting but more or less included. The ventrals are more abdominal than in the figure; the pectorals falciform, inserted much higher; the caudal emarginate. We even doubt that the described species belongs to the *Mugilidae* at all, as the first dorsal has five spines instead of four, as in all *Mugilidae*; as the ventrals have, according to the figure, one spine and 4 rays, while in all *Mugilidae* the ventrals have I. 5. Further on account of the character of the caudal peduncle, of the pectorals and their base, of the construction of the operculum, which are different from those of the *Mugilidae*.

We suppose that some mistake must have taken place. The figure has a superficial likeness with *Carassiops*.

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4. Fam. Atherinidae.

More or less elongate, subcylindrical or somewhat compressed, covered with cycloid or ctenoid scales of moderate or small size. No lateral line but the posterior lateral scales may have a pit or a rudimentary tube; a silvery band along the sides, sometimes underlaid by black pigment. Eyes lateral, without gelatinous eyelids. Cleft of mouth moderate, extending to or beyond anterior margin of eye. Mouth usually terminal, more or less oblique; intermaxillaries more or less protractile, maxillaries without supplemental bone. Jaws equal or not. Teeth usually small, on jaws, also on vomer, palatines and pterygoids where they may be wanting. First dorsal with 4—8 weak spines or 4—5 undivided rays or 1 spine and 3—6 undivided rays, only in one genus 5 strong spines. It is situated before, opposite to or behind anus. Second dorsal removed from first,

opposite to anal, which is usually longer, has a single weak spine but resembles it otherwise. Ventral fins small, usually abdominal. Pelvic bones connected by ligament to the cleithra. Pectorals moderate or small, inserted high up. Caudal emarginate. Third and fourth superior pharyngeals of each side anchylosed, bearing teeth. Lower pharyngeals separate. No filtering apparatus. Gillopenings wide. Gillmembranes not connected, free from isthmus. Branchiostegals 5 or 6. Gillrakers usually long and slender. Vertebrae numerous, 32—60.

Carnivorous fishes of small size, often living in shoals along the coasts of tropical and temperate seas, some entering rivers, other living only in fresh water.

Synopsis of the indo-australian Atherinidae.

I. Origin of anal far distant from first dorsal.
  1. Vent about in middle of distance between snout and caudal. Origin of first dorsal above, slightly before or behind vent. Caudal peduncle as long as or longer than anal. More than 12 long slender gillrakers. A. I. 10—18 (indo-australian species of) *Atherina* p. 268.
  2. Vent in posterior half of distance between snout and caudal. Origin of first dorsal before vent, its hindborder above it. Caudal peduncle longer than anal, about 10 very short and thick gillrakers. A. I. 8—10 . . . . . *Craterocephalus* p. 277.

II. Origin of anal only slightly behind first dorsal.
  1. Vent in posterior half of distance between snout and caudal. Origin of first dorsal before vent. Caudal peduncle shorter than anal. 15—20 long gillrakers. A. I. 11—13 . . . . . *Telmatherina* p. 278.

III. Origin of anal at least before hindborder of first dorsal.
  1. Vent in posterior half of distance between snout and caudal. Origin of first dorsal above or behind vent. Caudal peduncle as long as or longer than anal. A. I. 9—12. Small, elongate. . . . . *Pseudomugil* p. 282.
  2. Vent in anterior half of distance between snout and caudal. Origin of first dorsal somewhat before, generally behind vent, its hindborder always behind it. Caudal peduncle shorter than anal. A. I. 17—30. . . . . *Melanotaeniinae* p. 286.

1. Atherina (Artedi) Linné.

(Linné, Syst. nat. ed. X*a*. 1758, p. 315).

Physoclistic; more or less elongate, subcylindrical or compressed; covered with cycloid or ctenoid scales of moderate or small size. No perforated lateral line. A silvery band along the side, sometimes underlaid by black pigment. Head flattened above. Eyes lateral, well developed, without a gelatinous eyelid. A pair of not widely separated nostrils between snout and eye. A spinous dorsal of 5 to 8 more or less flexible spines, situated before or opposite to anus. It is entirely separated

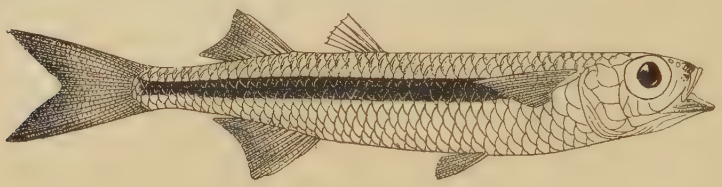

Fig. 70. *Atherina valenciennesi* Blkr. n. s.

from the second dorsal, which is formed by branched rays. Anal with a weak spine; usually longer than the soft dorsal, which it otherwise resembles. Ventral fins abdominal, small, with a spine and 5 branched rays. Pectorals moderate or small, inserted high up. Jaws about equal. Cleft of mouth straight, terminal, oblique, moderate, extending to or beyond anterior margin of eye, bordered by mandibles and intermaxillaries, which may be protractile; the maxillaries are excluded. Teeth usually small, on jaws, also on vomer, palatines and pterygoids, where they may be wanting. Vertebrae with the parapophysis co-ossified with the centra; numerous: 32 to 60. Parietals present; no splenial; pterotic not reaching basioccipital. Gill-openings wide, gillmembranes not connected, free from isthmus; 5 or 6 branchiostegal rays. Four gills, a slit behind the fourth.

Carnivorous fishes of small size, living in shoals in temperate and tropical seas near the coast, in brackish water, several species even entering fresh water.

Key to the indo-australian species of Atherina.

I. Origin of first dorsal about opposite to anus, which is situated 1 or 2 scales behind tip of ventrals. Vertical through origin of first dorsal much nearer to base of ventrals than to anal . . . . . *A. temmincki* p. 269.

II. Anus conspicuously before first dorsal; situated between ventrals, at least between their tip. Vertical through origin of first dorsal nearer to anal than to base of ventrals.

1. Pectorals 5 times or less in total length. Tip of ventrals reaching vertical through origin of first dorsal. That vertical separated from vertical through anus by 3 scales. Lateral scales 34—36 . . . . . *A. eendrachtensis* p. 270.

2. Pectorals more than 5 times in total length. Tip of ventrals only by exception reaching vertical through origin of first dorsal.

a. Vertical through anus and vertical through origin of first dorsal separated by 7—8 scales. *A. valenciennesi* p. 272.

b. Vertical through anus and vertical through origin of first dorsal separated by 3—4 scales.

α. Lateral scales 42—45. Origin of first dorsal opposite to 15th (16th) scale, that of second dorsal opposite to 25th (26th) scale. Anus opposite to 12th—14th scale . . . . . *A. forskâli* p. 274.

β. Lateral scales 35—40. Origin of first dorsal opposite to 13th—14th scale, that of second dorsal opposite to 21st—23rd scale. Anus opposite to 9th—10th scale . . . . . *A. duodecimalis* p. 275.

1. Atherina temmincki Blkr.

? *Atherina brachypterus* Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 243.
Atherina Temminckii Bleeker, Nat. Tijdschr. Ned. Ind. V. 1853, p. 506.
Atherina Temmincki Jordan & Seale, Proc. U. S. Nat. Mus. Wash. XXVIII. 1905, p. 774.
? *Atherina uisila* Jordan & Seale, Bull. Bur. Fish. Wash. XXV. (1905) 1906, p. 216.
Atherina temminckii Evermann & Seale, Bull. Bur. Fish. Wash. XXVI. 1906, p. 59.
Atherina Temminckii Max Weber, Siboga-Expeditie, Fische 1913, p. 135.
Atherina temmincki Max Weber, Revision indo-austr. Art. v. Atherina, Zoolog. Mededeel. Mus. Leiden VI. 1921, p. 52.

D^1. VI; D^2. I—II. 8—9; A. II. 10—11; V. I. 5; P. I—II, 15—17; L.l. 40—44; L.tr. 6.

Somewhat cylindrical, back broad, flat, breadth of trunk equal to or somewhat less than its height. Height $6^1/_2$ to nearly 8 in total length. Head 4.5 to slightly more than 5 in total length; pointed, its upper surface nearly flat and rectilinear; jaws equal; mouth small; maxillary obliquely ascending, reaching frontborder of eye; snout much shorter than eye, about 3.8—4 times in head. Eye 2.5 to less than thrice in head,

equal to or shorter than interorbital space and about equal to postorbital part of head. Origin of first dorsal opposite to 14th, usually 15th scale, and about opposite to anus; its vertical much nearer to origin of ventrals than to that of anal. Anus about 1 or 2 scales distant from end of ventrals. Origin of second dorsal opposite to (25th) 26th scale and to first $^1/_4$ of anal; its distance from origin of first dorsal somewhat shorter than length of head; both fins separated by 7 interdorsal scales. There are 17—19, usually 18 scales between first dorsal and occiput. Pectorals 6.6 to 7.7 in total length, their tip reaching 8th or 9th scale. Distance of origin of second dorsal from root of caudal equal to or somewhat longer than head. Scales entire. Caudal peduncle measured behind second dorsal about $^2/_3$ of length of head. About 21—22 gillrakers on lower limb of first arch, the longest somewhat shorter than pupil. Teeth in jaws very small and in narrow bands, those on vomer, palatines and pterygoids more conspicuous and stronger. Lateral band silvery, about $1^1/_2$ times as broad as pupil, its upper border with a blackish hue; the scales above it with bluish email-coloured points on a dark ground; they may be confluent along the border of the scales; fins hyaline, the upper border of the pectorals and the caudal with a dark hue. Length 100 mm. [Specimens of BLEEKER's collection seen by us].

Habitat: Pulu Weh!; Sumatra (Priaman); Pulu Babi (Telok Berandang!); Java (Batavia); Island Kawassang (Paternoster Islands!); Flores!; Adonare!; Timor; Sumba!; Celebes (Makassar, Badjoa, Menado); Saleyer!; Siao!; Ternate; Gisser!; Ceram (Kawa!); Island Fau near Gebe!; Kei Islands (Tual!); Kur Island!. — Philippines, ?Samoa (*Atherina uisila* Jordan & Seale).

2. Atherina eendrachtensis Q. & G. [1]).

Atherina endrachtensis Quoy & Gaimard, Voyage de Freycinet, Zoologie 1824, p. 334.
Atherina endrachtensis Cuvier & Valenciennes, Hist. Nat. Poissons X. 1835, p. 456.
?*Atherina bimanensis* Bleeker, Journ. Indian Archipelago II. 1848, p. 637 [2]).

1) We have changed the original specific name *endrachtensis* in *eendrachtensis*, as it is derived from the old dutch name "het land Eendracht" for Australia; *endrachtensis* does not belong to any language.

2) The type of this species is lost and the diagnosis very incomplete, but it contains characters, which make it possible, that it was based on a specimen or specimens of *A. eendrachtensis* Q. G. (see M. Weber, Revision etc. l. s. c. p. 46).

Atherina endrachtensis Bleeker, Arch. néerl. sc. nat. Haarlem XIII. 1878, p. 53 (name only).

Atherina endrachtensis Sauvage, in Grandidier, Hist. nat. Madagascar XVI. Poissons 1891, p. 406.

?*Atherina endrachtensis* Kendall & Goldsborough, Mem. Mus. Comp. Zool. Harvard College XXVI. No. 7, 1911, p. 254 [1]).

Atherina eendrachtensis Max Weber, Siboga-Expeditie Fische, 1913, p. 136.

Atherina endrachtensis de Beaufort, Bijdr. Dierkunde Afl. 19, Amsterdam 1913, p. 106.

Atherina eendrachtensis Max Weber, Revision indo-austr. Art. v. Atherina, Zoolog. Mededeel. Mus. Leiden VI. 1921, p. 47.

D^1. (IV) V; D^2. II. 7—8; A. II. 9—12; P. I. 14; V. I. 5. L. l. 34—36 et parvi; L. tr. 6.

Compressed, height about 5 to 5.5 times in total length. Head and anterior part of back stout, flattened, broad, its breadth above pectorals about $^2/_{10}$ shorter than height on that place. Head 4.2 to 4.5 in total length, 3.2 to 3.7 times in length without caudal; its upper surface broad, flat, even slightly concave, rectilinear to broad, blunt snout, which is shorter than half length of eye; mouth small, upper jaw somewhat prominent, maxillary obliquely ascending, nearly reaching vertical through frontborder of pupil. Eye about 2.3 to 2.5 in head, equal to interorbital space but longer than postorbital part of head. Origin of first dorsal opposite to 12th, usually 13th scale, in small specimens midway between root of caudal and anterior part of pupil. With increasing length the anterior end of that measurement is shifted backward to hindborder of eye, so that finally the origin of the first dorsal is midway between hindborder of eye and root of caudal [2]). The vertical through that origin is much nearer to anal than to base of ventrals. Origin of second dorsal opposite to 20th scale and to anterior third of anal. Anus opposite to 9th, usually 10th scale, 3 scales before vertical through origin of first dorsal, situated between posterior half to ultimate quarter of ventrals, the tips of which reach the said vertical or nearly so. Origin of first dorsal from that of second dorsal a distance contained about 1.7 to

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1) The authors unite under this species a number of specimens from Fiji, Caroline and Marshall Islands. Of some of them a few characteristics are notified; these specimens certainly do not belong to *endrachtensis* Q. G. but possibly to *A. temmincki* Blkr. But the descriptions are too incomplete to settle this question.

2) As in *A. duodecimalis*, we suppose that in the short synopsis given by Sauvage (l. c. p. 406) of the species of *Atherina*, in the Paris Museum "bord postérieur de l'oeil" stands for "bord antérieur".

1.8 times in length of head. Both fins are separated by 5 (by exception 6) interdorsal scales. There are 16 scales between first dorsal and occiput. Distance of origin of second dorsal from dorsal root of caudal shorter than head. Pectorals falcate, 4.5 to 4.8 in total length; their tip reaching 9th to 12th, usually 10th scale. Caudal peduncle, measured behind dorsal, about equal to half length of head. Scales entire, in old specimens somewhat crenulated. About 23 gillrakers on lower limb of first arch, the longest about $^1/_3$ the length of the eye. Teeth in jaws in a rather broad band, its breadth increasing with age, they are relatively strong on vomer, palatines and pterygoids. Silvery lateral band usually rather narrow and dorsally bordered with black, which may be as broad as the silvery band below it. In the middle of the lateral band a longitudinal series of diffuse dark brown dots, one on each succeeding scale; a second series in the ventral border of the silvery band or somewhat below it and reaching lower surface of caudal peduncle; a third series, still shorter, about one scale below the second series. Scales above the lateral band dusky and more or less edged with dark brown, more pronounced on median and anterior part of back and on upper surface of head; tip of snout and of mandible dusky. Base of pectorals and their upper half dusky as also the other fins, especially the caudal. Length 116 mm.

Habitat: Nias!; Sailus ketjil (Paternoster Islands!); Sumbawa!; Celebes (Menado!); Island Biaru!; Ceram!; Banda!; Aru Islands (Dobo!); Waigeu!; New Guinea [VALENCIENNES]. — South West Australia.

Note. This species is widely distributed through the Archipelago. It was therefore remarkable that BLEEKER had not received it from one of the many places wherefrom he got collections. Apparently he did not recognise it; for the Museum of Amsterdam possesses two badly preserved specimens from BLEEKER's collection named by him *Ath. duodecimalis* C. V. which really belong to *Ath. eendrachtensis*.

3. Atherina valenciennesi Blkr. [1]). [Fig. 70, p. 268].

Atherina Valenciennei Bleeker, Nat. Tijdschr. Ned. Indië V. 1853, p. 507.
Atherina Valenciennesi Bleeker, ibid. XX. 1859—1860, p. 203.

1) BLEEKER himself corrected the wrongly spelt specific name "*Valenciennei*" and altered it in "*Valenciennesi*".

Atherina Valenciennesii Max Weber, Siboga-Expeditie, Fische 1913, p. 136.
Atherina valenciennesi Max Weber, Revision indo-austr. Art. v. Atherina, Zoolog. Mededeel. Mus. Leiden VI. 1921, p. 52.

D^1. V—VI; D^2. II. 7—8; A. II. 11; P. I. 13—14; V. I. 5; L.l. 41—43; L.tr. 6.

Compressed, its greatest breadth about $1^1/_2$ times in its height, which goes $6^1/_2$ times or somewhat more in total length. Head 5.3—5.8 in total length, pointed; its upper surface nearly flat, anteriorly only slightly declivous, jaws equal; mouth small; maxillary strongly ascending, reaching frontborder of eye or slightly passing it. Snout much shorter than eye, somewhat more or less than 4 times in head. Eyes 2.3 to nearly 3; equal to or shorter than interorbital space, which has a large thin scale; postorbital part of head about equal to eye. Origin of first dorsal opposite to 15th or 16th scale, its vertical much nearer to anal than to origin of ventrals and nearer to base of caudal than to end of snout, 3 to 4 scales distant from tips of ventrals and (6) 7 to 8 scales behind anus. Origin of second dorsal opposite to 24th, 25th or 26th scale, its distance from origin of first dorsal contained 1.2 to 1.3 in length of head; both fins separated by 5 to 6 interdorsal scales. Anus opposite to 8th or 10th scale and situated in anterior third or in middle of length of ventrals. Pectorals 5.7—6.6 in total length, their tip reaching 9th or 10th scale, reaching therefore or surpassing vertical through anus. Distance of origin of second dorsal from caudal about $^1/_5$ of length of head longer than that length. Length of caudal peduncle measured behind second dorsal equal to head without snout or somewhat longer. Scales crenulated. About 18—20 scales between first dorsal and interorbital space. About 22 gillrakers on lower limb of first arch, their greatest length somewhat less than pupil. Teeth very small in bands on jaws, vomer, pterygoids and palatines. Lateral band silvery, black above; occupying nearly the entire third series of scales. The scales above it with black points, especially the median series of back and the neighbouring series of scales with black edges and longitudinal markings. Caudal dusky, with a diffuse blackish border. Length 95 mm. [Specimens of BLEEKER's collection seen by us].

Habitat: Singapore; Sumatra (Padang); Java (Batavia!, Samarang!, Surabaia!, Pekalongan!, Panarukan!, Karang Bol-

long); Borneo (Kota Baru!, Balik-papan!); Celebes (Makassar!); Flores!; Biaru Island!.

4. Atherina forskåli Rüpp.

Atherina Forskålii Rüppell, Neue Wirbelth. Fische 1835, p. 132.
Atherina forskåli Cantor, Journ. Asiat. Soc. Bengal XVIII. (1849) 1850, p. 1085.
Atherina lacunosa Bleeker, Nat. Tijdschr. Ned. Indië V. 1853, p. 504.
Atherina pinguis Bleeker, Acta Soc. Sc. Indo-Neerland. VIII. 1860, 8ste Bijdr. vischfauna Sumatra, p. 84.
? *Atherina forskålii* Günther, Cat. Brit. Mus. III. 1859—1861, p. 397.
Atherina pinguis Klunzinger, Abh. zool. bot. Gesellsch. Wien XX. 1870, p. 833 (p.p.).
Atherina forskali Day, Fishes of India 4°, 1878—1888, p. 345.
Atherina Forskålii Klunzinger, Fische d. Roth. Meeres 1884, p. 130.
? *Atherina forskalii* Seale, Philippine Journ. of Sc. V. No. 4, 1910, p. 268.
Atherina Forskåli Max Weber, Siboga-Expeditie, Fische 1913, p. 134.
Atherina forskali Jordan & Hubbs, Ann. Carnegie Mus. Vol. XI. Nos. 3 & 4, 1917, p. 462.
Atherina forskåli Max Weber, Revision indo-austr. Arten v. Atherina, Zoolog. Mededeel. Mus. Leiden VI. 1921, p. 47.

D^1. V; D^2. II. 8; A. II. 11—13; P. I. 13—15; V. I. 5. L. l. 42—45; L.tr. 6.

Compressed, its greatest breadth about $1^1/_2$ times in its height. Height 4.7 to 6.4 times in total length, according to size. Head 4.3 to 4.9 in total length, pointed, its upper surface flattened but slightly convex in interorbital part, wherefrom it is decidedly declivous to point of snout. Mouth comparatively large, the jaws equal, the maxillary reaching to below pupil or nearly so. Snout much shorter than eye, more or less than 4 times in head. Eye 2.5—2.7, about equal to postorbital part of head and to interorbital space. Origin of first dorsal opposite to 15th, by exception to 16th scale, midway or somewhat nearer to root of caudal than to frontborder of eye; its vertical much nearer to anal than to base of ventrals, and about 2 scales behind anus. Origin of second dorsal opposite to 24th to 26th, usually to 25th scale and to about end of anterior third of anal; its distance from origin of first dorsal contained 1.3 to 1.6 in head. Both fins are separated by 6 to 8, usually 7 interdorsal scales. Distance of origin of second dorsal from caudal equal to or longer than head. Length of caudal peduncle, measured dorsally, shorter than distance from point of snout to hindborder of eye, about twice in length of head. Pectorals 5.3 to 6.5 in total length; their tips reaching

8th, 9th or usually 10th scale. Anus opposite to 12th or 14th, usually to 13th scale, situated between tips of ventrals or immediately behind their end, about 2 scales before vertical through first dorsal. Scales entire or somewhat sinuated, about 18 to 20 between first dorsal and head, a very large and rounded one on interorbital space, behind it a longitudinal one on nape. About 20 gillrakers on lower limb of first arch, the longest about equal to half length of eye. Teeth in rather broad bands on jaws, pterygoids, palatines and vomer. Sides of head and lower surface of body silvery, not sharply defined from the broad silvery lateral band, the upper part of which shows an indistinct dark band. Above it the scales have broad brown borders and brown points. Fins dusky, usually more pronounced on hindborder of caudal; upper half of pectorals often with blackish points. Upper surface of head more or less blackish as also ventral border of lower jaw. Length 130 mm.

Habitat: Singapore; Pulu Weh!; Simalur!; Pulu Babi (Telok Berandang!); Sumatra (Olehleh!, Pulu Pangang!, Trussan, Padang, Benkulen); Java (Samarang!, Batavia); Bawean Island; Kawassang (Paternoster Islands!); Bali; Celebes (Makassar!, Bonthain, Badjoa, Menado!); Flores (South coast!); Sumba (South coast!); Timor; Buton!; Ternate; Ambon!; Kajoa!; Obi major!; Banda!; Island Fau near Gebe!; Aru Islands!; Waigeu (Saonek!); Goram Islands; New Guinea. — Red Sea, Zanzibar, Madagascar, Mauritius, Nicobars, Andamans, Pinang, Tonkin, Philippines, New Caledonia(?), New Hebrides(?), Aneiteum (?).

5. **Atherina duodecimalis** (C.V.) Blkr.

? *Atherina duodecimalis* Cuvier & Valenciennes, Hist. Nat. Poissons, X. 1835, p. 458.
Atherina duodecimalis Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 485.
Atherina duodecimalis Günther, Cat. Brit. Mus. III. 1859—1861, p. 400.
? *Atherina duodecimalis* Day, Fishes of India 4°. 1878—1888, p. 345.
Atherina duodecimalis Sauvage, Hist. nat. Madagascar XVI. Poissons 1891, p. 406.
? *Atherina duodecimalis* Bean & Weed, Proc. U. S. Nat. Mus. Wash. 42, 1912, p. 596.
Atherina pinguis Max Weber, Siboga-Expeditie, Fische 1913, p. 135.
Atherina duodecimalis Max Weber, ibid, p. 136.
Atherina duodecimalis de Beaufort, Bijdr. Dierkunde Afl. 19, Amsterdam 1913, p. 105.
Atherina temminckii de Beaufort, l.c. (p. p.).
Atherina duodecimalis Max Weber, Revision indo-austr. Arten v. Atherina, Zoolog. Mededeel. Mus. Leiden VI. 1921, p. 47.

D^1. V—VI; D^2. II. 8 (I. 9); A. II. 9—12 (13); P. I. 13—15; L.l. 35—38 (40); L.tr. 6.

Compressed, its greatest breadth about $1\,^1/_2$ times in its height. Height 5.4—6 in total length, less than 4 times without caudal. Head 4.3—4.6 in total length, bluntly pointed, its upper surface flat, slightly declivous. Mouth rather small, lower jaw somewhat prominent, strongly ascending, reaching to frontborder of eye or somewhat passing it. Snout short, about half length of eye, more than 4 times in head. Eye 2.2—2.4, conspicuously longer than postorbital part of head and interorbital space, which is somewhat concave. Origin of first dorsal opposite to 13th or 14th scale, about in the middle between frontborder of eye and caudal; its vertical 3—4 scales behind anus and much nearer to anal than to base of ventrals. Origin of second dorsal opposite to 21st to 23rd scale and to about the first $^1/_5$ of anal; its distance from origin of first dorsal 1.5 to 1.7 times in length of head. Both fins are separated by 5 interdorsal scales. Distance of origin of second dorsal from caudal longer than head. Length of caudal peduncle measured behind dorsal, longer than head. Pectorals more than 5 to 6 times in total length; their tips reaching 9th or 10th scale. Anus opposite to 9th or 10th scale, situated in middle or past middle of length of ventrals, their end reaching vertical through first dorsal or nearly so. Scales entire or some of them slightly indentated; about 16 to 17 before first dorsal and usually 2 large ones on interorbital space and occiput. About 20 gillrakers; the longest equal to half length of eye. Teeth in rather narrow bands on jaws, palatines, pterygoids and vomer. In alcohol yellowish brown, with a silvery hue below the lateral silvery band, the upper part of which is transparent darkish. The scales above it have a lighter or darker margin of different breadth, formed by more or less numerous dark brown points. Fins more or less dusky, especially the caudal and the base of the pectorals. Length 97 mm. [Specimens of BLEEKER's collection seen by us].

Nom. indig.: Lumbungan (Batavia); Kaluna (Saparua).

Habitat: Singapore; Pulu Weh!; Simalur!; Nias!; Sumatra (Benkulen, Telok Betong, Trussan, Padang); Riouw Archipelago; Banka; Biliton; Natuna-Islands; Java (Batavia!); Bawean Island; Borneo (Kota baru!); Bali; Lombok; Sumbawa; Sumba!; Flores!; Adonare!; Celebes (Makassar!, Bonthain, Menado); Buton!; Timor (South coast!); Ambon!; Ceram!; Batjan; Ter-

nate; Waigeu!; Goram Island; Saparua Island; Aru Islands!; New Guinea (Doreh). — Ceylon.

2. Craterocephalus Mc Culloch.

(Mc Culloch, Proc. Royal Soc. Queensland XXIV. 1912, p. 48.
Jordan & Hubbs, Stanford University Publications, 1919, p. 44).

Elongate, somewhat compressed. Mouth very small, oblique, bordered by intermaxillaries; the maxillaries behind them, not reaching frontborder of eye. Intermaxillaries very protractile, straight. Very small teeth in both jaws, none on palate. First dorsal with 6—8 flexible spines, its origin well behind that of ventrals, second dorsal with one spine and 7—9 rays. Anal with a weak spine and 8—10 soft rays, its origin somewhat in advance of that of second dorsal. Ventrals with a slender spine and 5 soft rays. Pectorals inserted rather high up, above the middle of the height of the body. Caudal forked. Scales smooth or somewhat crenulated behind, rather large, 31—39 between head and caudal, extending to between eyes on the head. Cheeks and operculum scaly. Lateral line absent or scales pierced by a simple pore. Gillrakers very short, thick, pointed, about ten on lower limb of first arch. Gillmembranes free from isthmus and from each other. Vertebrae 37.

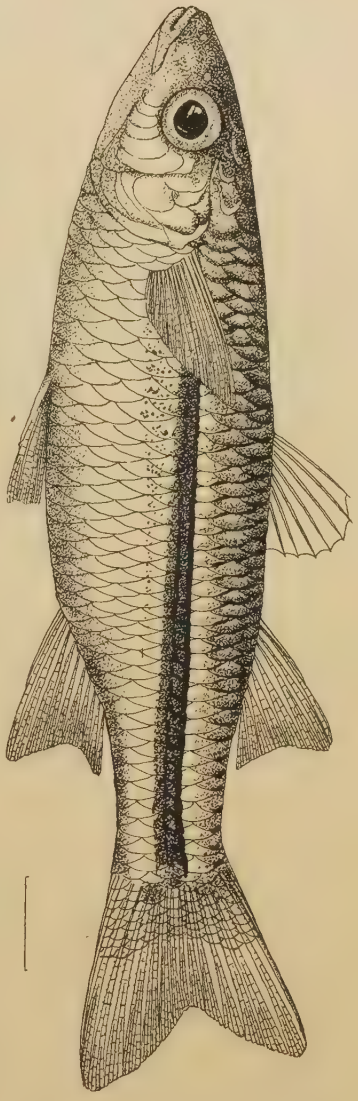


Fig. 71. *Craterocephalus nouhuysi* (M. Weber) × 1.2.

Distribution: Freshwater of Australia. One species in Southern New Guinea.

1. Craterocephalus nouhuysi (M. Web.). [Fig. 71, p. 277].

Atherinichthys Nouhuysi Max Weber, Notes Leyden Mus. XXXII. 1910, p. 229. — Nova Guinea IX. Zool. Livr. 4, 1913, p. 555.

Craterocephalus nouhuysi Jordan & Hubbs, Stanford University Publications, 1919, p. 46 (name only).

D^1. 6—7; D^2. I. 8—9; A. I. 10; P. 1. 13—15; V. 1.5; L. l. 36—39; L. tr. $7^1/_2$—$9^1/_2$.

Elongate, somewhat compressed, belly before ventrals more flattened, back and head somewhat rounded. Height 4—4.3, 4.6—5.4 in length with caudal. Head 3.6—4.1, 4.5—5.2 in length with caudal. Eye about 3.5, shorter than snout and almost 1.5 in rounded interorbital space, which is about equal to postorbital part of head. Mouth small, oblique. Intermaxillaries very protractile, almost straight. Maxillaries broadened in their proximal part; almost entirely covered by the praeorbital when the mouth is closed. Lips somewhat swollen. Very fine teeth on the inner side of the jaws. Palate edentulous. One row of large scales on praeoperculum. Operculum scaly. 14—17 scales before dorsal. The scales reach to between eyes. Origin of first dorsal well behind that of ventrals. Origin of second dorsal somewhat behind that of anal. Pectorals as long as or somewhat longer than head without snout. Caudal forked. Colour of alcohol specimens yellowish brown, lighter below. A silvery lateral band from head to caudal. Sometimes a dark blotch at base of caudal. Fins hyaline. Length 120 mm.

Habitat: Southern New Guinea (Lorentz river and its tributaries!).

Fresh water.

3. Telmatherina Boulenger.

(Boulenger, Proc. Zool. Soc. London 1897, p. 428).

Compressed, more or less elongate. Mouth small, oblique, bordered by intermaxillaries and mandibles. Intermaxillaries with a gentle curve, the symphysial part more or less expanded horizontally. Maxillaries rodlike, hidden below praeorbital when the mouth is closed. Small, pointed teeth on intermaxillaries and mandibles. None on palate. Teeth on tongue. First dorsal consisting of 4—7 simple flexible rays, its origin slightly behind that of ventrals. Second dorsal with one simple ray and 8—11 branched rays, its origin slightly behind that of anal. Anal

with a feeble spine and 11—13 branched rays. Ventrals with a weak spine and 5 rays situated far behind origin of pectorals. Pectorals without spine. Caudal forked. Anus below first dorsal, at some distance before anal. Scales cycloid, with faint crenulations at their hindborder. Lateral line absent, indicated by some of the scales having a pit. Gillmembranes free from

Fig. 72. *Telmatherina celebensis* Blgr. × 1.4.

isthmus and from each other. 15—20 gillrakers on lower branch of first arch, slender, denticulated, almost as long as gillfringes.

Distribution: Lakes Matano and Towuti in the interior of Celebes.

Key to the indo-australian species of Telmatherina.

A. Snout equal to or shorter than eye. Less elongate, when specimens of equal length are compared.

1. A. I. 13—15. L. tr. $7^1/_2$—8. Pectorals as long as head without snout. . . . . *T. celebensis* p. 279.
2. A. I. 11. L. tr. $6^1/_2$. Pectorals shorter than head without snout. . . . . *T. bonti* p. 280.

B. Snout longer than eye. More elongate, when specimens of equal length are compared. A. I. 12—13. L. tr. $7^1/_2$. *T. abendanoni* p. 281.

1. Telmatherina celebensis Blgr. [Fig. 72, p. 279].

Telmatherina celebensis Boulenger, Proc. Zool. Soc. London 1897, p. 428.
Telmatherina celebensis Max Weber, Bijdragen Dierkunde, Afl. 19, Amsterdam, 1913, p. 206 (pro parte).

D¹. 6—7; D². I. 8—11; A. I. 13—15; P. 1. 14—15; V. I. 5; L.l. 32—34; L. tr. $7^1/_2$—8.

Compressed, somewhat elongate. Dorsal and ventral profile evenly convex. Height 2.8—3.9, 3.6—4.8 in length with caudal. Head 3.2—3.4, 4.1—4.3 in length with caudal. Eye about 3, somewhat longer than or equal to snout, equal to or slightly less than interorbital space, which is less than postorbital part of head. Mouth small, oblique, reaching to about half length of snout. Intermaxillaries gently curved, the symphysial part more or less horizontal. Jaws equal in front. Small pointed teeth in both jaws, none on palate. Small teeth on hinderpart of tongue. One row of scales on praeoperculum. Operculum with rather large scales. Dorsal separated by 14—16 scales from head (12 in all specimens examined from Lake Towuti). Origin of dorsal more or less behind origin of ventrals. Origin of second dorsal behind that of anal. First ray of first dorsal prolonged into a long filament in males, which reaches to end of second dorsal or even farther. Anal spine short, as long as that of ventrals, scarcely shorter than eye. Pectorals as long as head without snout. Caudal forked. Scales slightly crenulated along their hindmargin. Lateral line only indicated by some of the scales having a pit. Colour of alcohol specimens yellowish, browner above, the scales pigmented along their border giving a reticulate appearance to the back. In males there are moreover three more or less distinct brown crossbands, the first behind pectorals, the second between the two dorsals and the third running from hinderpart of second dorsal to anal. First dorsal blackish, the filamentous part white, second dorsal blackish except a broad white terminal margin, caudal and anal with a black medial crossband. In females these markings are much fainter or almost obsolete. Length 92 mm.

Nom. indig.: Opudi (Lake Matano).

Habitat: Celebes (lakes Matano! and Towuti!).

Fresh water.

2. Telmatherina bonti n. sp.

Telmatherina celebensis Max Weber, Bijdragen Dierkunde, Afl. 19, Amsterdam, 1913, p. 206 (pro parte).

D¹. V—VII; D². I. 8; A. I. 11; P. 1. 13; V. I. 5; L.l. 31—32; L. tr. $6^1/_2$.

Rather compressed, elongate. Height 3.3—3.5, 3.6—4.2 in length with caudal. Head 3.1—3.2, 3.4—3.9 in length with caudal. Eye more than 3, longer than snout and less than interorbital space, which is equal to postorbital part of head. Mouth small, reaching somewhat farther than half length of snout. Intermaxillaries gently curved, the symphysial part more or less horizontal. Jaws equal in front. Minute teeth in a narrow band in the jaws. No teeth on palate. A patch of teeth on tongue. Praeoperculum with one row of scales. One very large and several smaller scales on operculum. Dorsal separated by 12 scales from head, the foremost scale on occiput larger than the others. Origin of dorsal more or less behind that of ventrals. Origin of second dorsal behind that of anal. None of the rays prolonged in the two small specimens examined. Anal spine short, about equal to that of ventrals, shorter than eye. Pectorals shorter than head without snout. Caudal forked. Colour of alcohol specimens yellowish, somewhat darker above, where the scales are pigmented along their margins. A faint lateral black band, running from below dorsal to base of caudal. Length 60 mm.

Nom. indig.: Bonti-bonti (Towuti).

Habitat: Celebes (Lake Towuti!).

Note. One of us draw already attention to the fact, that the specimens called *bonti* by the inhabitants at lake Towuti, differ by having less anal rays from typical *T. celebensis*. We find some other differences (lateral line, length of pectorals) which seem us sufficient to describe them here as a separate species.

3. **Telmatherina abendanoni** M. Web. [Fig. 73, p. 281].

Telmatherina Abendanoni Max Weber, Bijdragen Dierkunde, Afl. 19, Amsterdam, 1913, p. 208.

D^1. 4—6; D^2. I. 9—10; A. I. 12—13; P. I. 12; V. I. 5; L.l. 33—34; L.tr. $7^1/_2$.

Compressed, elongate. Height 3.7—3.8, 4.6—4.8 in length with caudal. Head 3.1—3.5, 3.8—4.4 in length with caudal. Eye 3.7—4, shorter than snout, which is pointed and somewhat shorter than interorbital space, which is equal to postorbital part of head. Mouth rather small, reaching scarcely to vertical through middle of snout. Intermaxillaries gently curved, their symphysial part somewhat expanded horizontally. Narrow

bands of small teeth in both jaws. None on palate. Teeth on the tongue. One row of scales on praeoperculum. Operculum with rather large scales. Dorsal separated by 13—14 scales from head. Origin of dorsal more or less behind that of ventrals. Origin of second dorsal behind that of anal. First ray of dorsal somewhat produced (in males only?). Anal spine short, about equal to that of ventrals, shorter than eye. Pec-

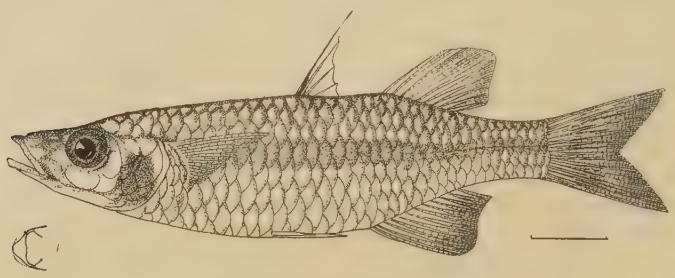


Fig. 73. *Telmatherina abendanoni* M. Weber. n. s.

torals as long as head without snout. Caudal forked. Colour of preserved specimens yellowish, the scales margined with brown, broader so on the back, where the pigment extends below the centre of the scales, the back being therefore darker. Fins somewhat dusky. Length 88 mm.

Habitat: Celebes (Lake Matano!).

4. **Pseudomugil** Kner.

(Kner, Novara Expedition, Fische, 1865—1867, p. 275).

Small, elongate fishes. Much compressed in their hinderpart, less so in the anterior half. Mouth small or large, very oblique, nearly vertical, bordered by mandibles, the symphysis of which is prominent, and by the intermaxillaries; maxillaries hidden when the mouth is closed. Small curved teeth in both jaws, some of them caniniform in males. Palate toothless. First dorsal consisting of 4—5 undivided rays; in indo-australian species far behind origin of ventrals, its origin before, above or somewhat behind that of anal or nearly so. Second dorsal with 6—8 branched rays, its origin behind that of anal. Anal with a slender spine and 9—12 rays. Ventrals abdominal. Fins with elongate rays in males. Caudal emarginate. Scales rather large, cycloid, much larger on head, where they reach to hinderpart

of crown and on opercles. Lateral line absent. Gillmembranes free from isthmus and from each other.

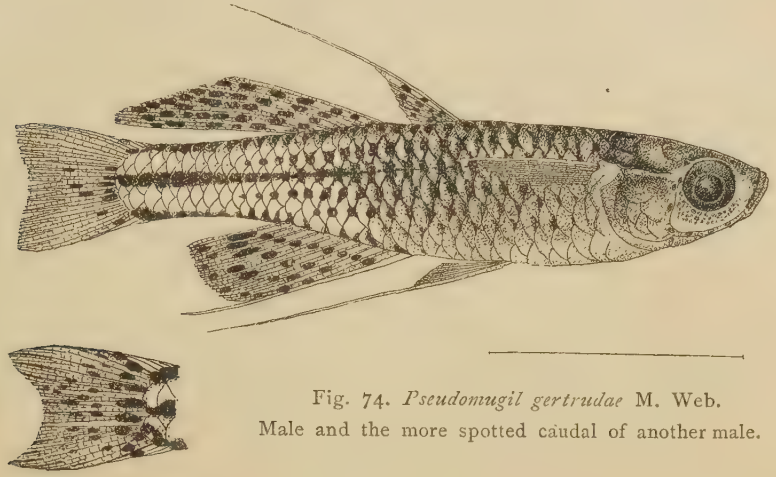


Fig. 74. *Pseudomugil gertrudae* M. Web.
Male and the more spotted caudal of another male.

Distribution: Freshwater of Queensland, N. S. Wales, Aru-Islands and Southern New Guinea.

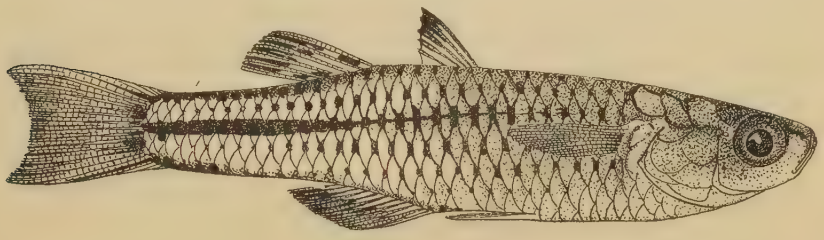


Fig. 75. *Pseudomugil gertrudae* M. Web. Female.

Key to the indo-australian species of Pseudomugil.

1. Origin of first dorsal well in advance of that of anal. Mouthopening small. . . . . *P. gertrudae* p. 283.
2. Origin of first dorsal above or slightly behind or before that of anal. Mouthopening large. . . . . *P. novae-guineae* p. 284.

1. Pseudomugil gertrudae M. Web. [1]) [Figs. 74, 75, p. 283].
Pseudomugil Gertrudae Max Weber, Abhandl. Senckenb. Naturf. Gesellsch. XXXIV. 1911, p. 23.

1) The specific name "*gertrudae*" is wrongly changed by JORDAN & HUBBS (Monograph. review of Atherinidae, Stanford University Publications 1919, p. 28) in "*gertrudei*".

D¹. 5; D². 6; A. I. 9—10; P. 9; V. 1.5; L.l. circa 30; L.tr. $6^1/_2$.

Rather elongate, compressed, more so in the posterior half of the fish. Upper profile nearly straight or slightly convex from snout to dorsal, lower profile slightly convex. Height more than 4, 5 in length with caudal. Head 3.8, 4.6 in length with caudal. Eye much longer than snout, somewhat less than interorbital space, which is equal to postorbital part of head. Mouthopening small, very oblique, not reaching vertical through frontborder of eye. Intermaxillaries and lower jaw with a row of very pointed teeth, which are somewhat curved backwards. Origin of first dorsal two or three scales in front of that of anal, separated by 10 scales from the large scales on crown. In males the dorsal and anal fins are much higher than in females, moreover the first ray of first dorsal, anal, ventrals and sometimes also of pectorals is prolonged into a long filament. Pectorals slightly shorter than head. Caudal emarginate. Yellowish, a dark lateral band from below first dorsal to caudal, widening posteriorly. Caudal peduncle with a similar median dorsal and ventral band, which are continued along base of dorsal and anal. Body covered with elongate dark blotches, corresponding with the scales and partly anastomosing, through which the body has a reticulate appearance. Fins more or less dusky in females, with a few black blotches on base of caudal and on second dorsal. In males both dorsals, anal and in a less degree caudal covered with blotches, which are arranged in longitudinal rows. Length 35 mm.

Habitat: Aru-Islands (Island Terangan!).

Fresh water.

2. **Pseudomugil novae-guineae** M. Web. [Fig. 76, p. 285].

Pseudomugil novae-guineae Max Weber, Nova Guinea V. Livr. 2, 1908, p. 232. — Abhandl. Senckenb. Naturf. Gesellsch. XXXIV. 1911, p. 25. — Nova Guinea IX. Livr. 4, 1913, p. 556.

D¹. 4; D². 8; A. I. 12; P. 10; V. 1.5; L.l. 31—32; L.tr. $6^1/_2$.

Elongate, compressed, more so in the posterior half of the fish. Upper profile nearly straight from snout to dorsal, lower profile slightly convex. Height about 5, 5.5 in length with caudal. Head nearly 4—4.5, 4.5 to more than 5 in length with caudal. Eye about 2.5, equal to postorbital part of head and to interorbital space. Mouthopening very oblique, rather large, not reaching vertical through frontborder of eye. Symphysis

of lower jaw forming the point of the head. Intermaxillaries and lower jaw with a narrow band of pointed teeth, which are curved backwards. In the male some of the teeth are larger and more or less caniniform. Origin of first dorsal above, slightly before or behind that of anal, separated by about 16 scales from the large scales of crown. In males the rays of the first dorsal are much prolonged and those of second dorsal and anal are also much longer than in females. Pectorals only slightly shorter than head. Caudal emarginate. Colour of alcohol specimens light yellowish, a dark lateral band begins

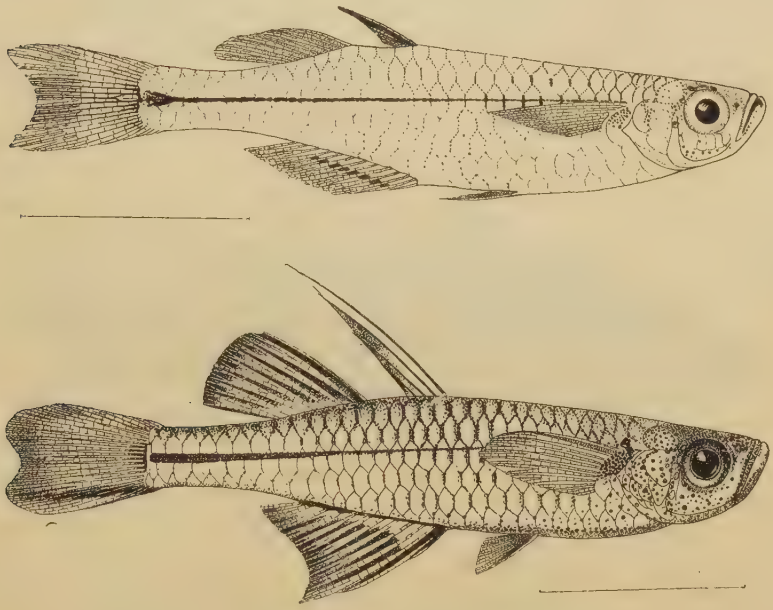


Fig. 76. *Pseudomugil novae-guineae* M. Weber. × 3.
Upper figure female, lower figure male.

before the middle of the body and ends broadening posteriorly, at base of caudal. Oblique dark, more or less complete lines, crossing each other and corresponding with the borders of the scales, give to the body a reticulate appearance. First dorsal black, other fins dusky with a black intramarginal band on the anal, more developed in males than in females. Length 43 mm.

Habitat: South New Guinea (river Wagani!, Lorentz river!); Aru-Islands!.

Fresh water.

Subfam. Melanotaeniinae.

Much compressed, oblong. Height increasing with age and dorsal and ventral profile getting more convex, especially the ventral profile; the dorsal profile generally sloping down in an almost straight line to snout. Head more or less pointed, its crown flattened; the jaws being equal or the upper one the longer, the lower one included; the upper one may also fit into a sinuation of the lower jaw. Mouthopening moderate or small, reaching frontborder of eye or not so far. Lips thickened or not. Intermaxillaries bordering the mouthopening, gently curved or with an abrupt bent between their horizontal and lateral part. Maxillaries rodlike, thin, slightly visible or not when mouth is closed. Teeth conical, pointed, in one or more rows in jaws, often extending on outside of

Fig. 77. *Melanotaenia patoti* M. Web. n. s.

lips; on vomer, palatines and tongue present or absent. First dorsal composed by exception of 4 to 5 strong spines, usually of 1 spine and 3—6 more or less flexible, undivided rays; its origin above or behind anus. Second dorsal with one spine and 8—17 soft rays, the posterior ones may be prolonged. Anal with one spine and 17—30 soft rays, the most posterior of which may also be prolonged; its origin before, below or behind that of the first dorsal. Ventrals with 1 spine and 5 rays, their origin below or behind that of pectorals. Scales regularly or irregularly arranged; 30—60 in a row between head and caudal; smooth or with faint or deep crenulations along their hindmargin. Lateral line absent or indicated by a shallow pit on some of the scales. 5 or 6 branchiostegals.

12—16 short dentated, or 30 long and slender gillrakers on the lower part of the anterior arch.

Rather small fishes, living in rivulets, streams and lakes of Australia, New Guinea and neighbouring islands (Aru-Islands, Waigeu).

Note. The indo-australian genera and species of Melanotaeniinae are also treated by JORDAN & HUBBS (A monograph. review of the family of *Atherinidae*, Stanford University Publications 1919). As the authors had not the benefit to see the species themself, their treatement of them is a replica of that of C. T. REGAN. His descriptions are quoted under the genera and species named on the following pages. We therefore did not think it necessary to quote also the identical names used again by JORDAN & HUBBS.

Key to the indo-australian genera of Melanotaeniinae.

I. Scales regularly arranged, 30—44 in a row between head and caudal, smooth or with faint crenulations.
  A. Intermaxillaries with an abrupt bent between their horizontal and lateral part. L.l. 30—39.
    a. Teeth not extending on outside of lips, which are not thickened. Mouthopening rather small, not reaching vertical through frontborder of eye. *Melanotaenia* p. 287.
    b. Teeth extending on outside of lips, which are thickened. Mouthopening comparatively large, reaching to vertical through frontborder of eye or nearly so . . . . . *Rhombatractus* p. 296.
  B. Intermaxillaries without an abrupt bent between their horizontal and lateral part. L.l. 40—44.
    a. First dorsal with 4—5 spines. Palate toothless. *Centratherina* p. 305.
    b. First dorsal with one spine and 3—5 soft rays. Teeth on vomer. . . . . *Chilatherina* p. 307.

II. Scales irregularly arranged, 55—60 in a row between head and caudal, deeply crenulated along their hindmargin . . . . . *Glossolepis* p. 309.

1. Melanotaenia Gill.

(GILL, Proc. Acad. Philadelphia 1862, p. 280; MAX WEBER, Nova Guinea V. Livr. 2, 1908, p. 238).

Nematocentris Peters, Monatsber. Akad. Berlin 1866, p. 516.

Strabo Kner & Steindachner, Sitzungsber. Akad. Wien LIV. 1866, p. 372.
Zantecla Castelnau, Proc. Zool. Soc. Victoria II. 1873, p. 88.
Aida, *Neoatherina* Castelnau, Research Fish. Austral. 1875, p. 10, p. 31.

Fig. 78. *Melanotaenia ogylbyi* M. Web.

Much compressed, oblong, the height increasing with age. Dorsal and ventral profile more or less convex. Jaws equal, or lower jaw included. Intermaxillaries with an abrupt bent between their horizontal and lateral part. Lips not thickened. Mouth moderate, mouthopening not reaching to vertical through front border of eye. Pointed teeth in one or more rows in jaws. Teeth on vomer; those on palatines and tongue present or absent. First dorsal with one spine and 3—6 flexible, undivided rays, which may be prolonged into filaments. Second dorsal with a more or less curved spine and 9—12 soft rays, the hinder ones of which may be elongated, as well as those of the anal, which has one rather weak spine and 17—22 soft rays. Origin of anal below or somewhat behind that of first dorsal. Ventrals with a slender spine and 5 soft rays, originating somewhat behind the pectorals, which have no spine. Caudal forked.

Scales smooth or with shallow crenulations at their hindborder, moderate, 30—36 between head and caudal. Lateral line absent or indicated by some of the scales having a shallow pit. Five or six branchiostegals. Twelve to 16 short, dentated gillrakers on the lower part of the anterior arch.

Distribution: Freshwater of New Guinea, Aru Islands and Australia south to Sydney.

Key to the indo-australian species of Melanotaenia.

I. Praedorsal scales 24—31. L.l. 37—40.
  1. Pectorals much longer than head without snout. Caudal peduncle 1.5 as long as high. Mouth-opening with a very slight downward curve, when seen in front. Base of anal longer than distance from origin of first to end of second dorsal. Jaws equal . . . . . *M. multisquamata* p. 290.

II. Praedorsal scales less than 24. L.l. less than 37. Base of anal equal to distance from origin of first to end of second dorsal (or in *dumasi* eventually slightly longer).
  A. Upper jaw slightly prominent. Pectorals longer than head without snout. Mouthopening a horizontal straight line when seen in front. . *M. dumasi* p. 290.
  B. Jaws equal, or lower jaw slightly prominent. Pectorals equal to head without snout.
    1. Mouthopening a horizontal straight line, when seen in front. Jaws equal. One row of scales below eye . . . . . *M. patoti* p. 291.
    2. Mouthopening with a gentle downward curve, the upper jaw fitting into a sinuation of the lower jaw.
      a. Lower jaw slightly prominent. Origin of dorsal and anal opposite. One row of scales below eye. L.l. 30—33. Caudal with black blotches . . . . . *M. maculata* p. 292.
      b. Jaws equal. Origin of dorsal somewhat before that of anal. Two rows of scales below eye. L.l. 34—36. Caudal uniform. *M. ogylbyi* p. 293.

Doubtful species . . . . . { *M. loriae* p. 294. / *M.* (?) *rubrostriata* p. 295.

1. Melanotaenia multisquamata n.sp.

D^1. I. 4; D^2. I. 9—10; A. I. 19—20 (21); P. 1. 13—14; V. I. 5; L.l. 37—40; L.tr. 13—14.

Dorsal profile evenly convex, in older specimens much more elevated than in young ones. Ventral profile convex, especially so in older specimens. Height 2.5—2.8, 3.2—3.5 in length with caudal. Head 3.2—3.7, 4.2—4.6 in length with caudal. Eye 3.2—3.7, less than snout and than interorbital space, 1.4—1.6 in postorbital part of head. Mouthopening with a very slight downward curve in the middle, when seen in front. Jaws equal. Mouthopening reaching to about half length of snout. A row of strong conical teeth in the upper jaw, followed by smaller ones inside, especially well developed near the symphysis. Lower jaw with similar small teeth. A transverse patch of small teeth on vomer. Small teeth on palatines and on base of tongue. Subocular part of cheeks with two rows of scales. Large scales on operculum, excepting the superior ones, which are small. First dorsal separated by 24—31 scales from occiput. Spine of first dorsal strong, longer than postorbital part of head, somewhat shorter than that of second dorsal, which is still stronger and more curved. Anal spine rather strong, curved, shorter than postorbital part of head, about equal to length of operculum. Length of base of anal longer than distance between origin of first dorsal and end of second dorsal. Origin of first dorsal somewhat behind that of anal. Second dorsal and especially anal very high, the longest rays of anal as long as head, often much longer and almost equal to height of body. Pectorals not as long as head, but much longer than head without snout. Ventrals as long as head without snout. Caudal peduncle 1.5 times as long as high. Caudal forked. Scales conspicuously crenulated at their hindborder. Colour of preserved specimens pinkish, some rows of scales of the sides with more or less conspicuous dark pigmentation. First dorsal dusky. Distal part of second dorsal, anal and ventrals dusky or blackish. Pectorals and caudal hyaline. Length 140 mm.

Habitat: North New Guinea (Idenburg river!), collected by Jhr. W. C. VAN HEURN.

2. Melanotaenia dumasi M. Web.

Melanotaenia Dumasi Max Weber, Nova Guinea V. Livr. 2, 1908, p. 240. — Nova Guinea IX. Livr. 4, 1913, p. 558.

Anisocentrus rubrostriatus Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 281 (pro parte).

D^1. I. 4—5; D^2. I. 9—12; A. I. 17—21; P. I. 11—13; V. 1.5; L.l. 33—35; L.tr. 12—13.

Dorsal profile ascending almost in a straight line from snout to first dorsal in specimens of moderate size, but strongly convex behind nape in large specimens. Ventral profile convex. Height 2.2—3, 2.8—3.8 in length with caudal. Head 3.1—4, 4—5 in length with caudal. Eye 2.3—6.7, about equal to snout and considerably less than interorbital space. Mouthopening a straight line, when seen in front. Upper jaw slightly prominent. Mouthopening reaching to about half length of snout. An outer row of strong, more or less curved teeth in the jaws, followed by smaller ones inside. Small teeth on vomer, palatines and base of tongue. Subocular part of cheeks with two rows of scales. Large scales on operculum, excepting the superior ones, which are smaller. First dorsal separated by 17—20 scales from occiput. Spine of first dorsal equal to or longer than postorbital part of head, longer than that of second dorsal, which is thicker and more curved and much shorter than that of anal, which is about as long as eye. Length of base of anal equal to or somewhat longer than distance between origin of first dorsal and end of second dorsal. Origin of first dorsal somewhat behind or above that of anal. Pectorals curved, longer than head without snout. Caudal peduncle slightly longer than high, as high as long or higher than long (in large specimens). Scales crenulated at their hindborder. Colour of alcohol specimens brownish above, lighter below, the scales silvery in the lower part of the body, the longitudinal series being separated by wine-red stripes in fresh specimens. A more or less distinct darkish longitudinal band on the tail. Fins dusky. Length 150 mm.

Habitat: South New Guinea (rivers Wa Udu!, Wagani!, Lake Jamur!, Lorentz river!, Setakwa river).

Freshwater.

3. **Melanotaenia patoti** (M. Web.) [Fig. 77, p. 286].

Rhombatractus patoti Max Weber, Zool. Anz. XXXII. 1907, p. 403; Abh. Senckenb. Naturf. Gesellsch. XXXIV. 1911, p. 26.

Melanotaenia nigrans Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 279 (pro parte).

D^1. I. 3—4; D^2. I. 11—12; A. I. 18—20; P. 1.13; V. 1.5; L.l. 35; L.tr. 11—12.

Dorsal profile somewhat convex between occiput and dorsal. Upper profile of head slightly concave. Ventral profile convex. Height 2.4—2.8, 2.8—3.3 in length with caudal. Head 3.5—3.8, 4.1—4.7 in length with caudal. Eye more or less than 3, about equal to snout and considerably less than interorbital space. Mouth a straight line when seen in front. Jaws equal. Mouth-opening reaching to middle of snout or somewhat farther. A row of pointed teeth in both jaws, some smaller teeth behind this row, forming several rows near the symphysis of the lower jaw. Small teeth on vomer and on palatines. No teeth on tongue. Subocular part of cheeks with one row of scales. Large scales on operculum, excepting the superior ones, which are smaller. First dorsal separated by 15—17 scales from occiput. Spine of first dorsal longer than that of second dorsal and of anal, about equal to postorbital part of head. Origin of anal below or slightly behind that of first dorsal. Length of base of anal about equal to distance between origin of first dorsal and end of second dorsal. Pectorals curved, about as long as head without snout. Caudal peduncle longer than high. Scales smooth, some of them with faint crenulations on their hindborder. Colour of alcohol specimens brownish, lighter below. Third and 4th longitudinal row of scales blackish with a silvery gloss, the 6th and 7th form silvery bands. In fresh specimens these 5 bands are separated by wine-red lines. Fins dusky, wine red in life. Length 100 mm.

Habitat: Aru-Islands!.

Freshwater.

4. Melanotaenia maculata M. Web.

Melanotaenia maculata Max Weber, Nova Guinea V. Livr. 2, 1908, p. 239. — Nova Guinea IX. Livr. 4, 1913, p. 557.

Melanotaenia nigrans Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 279 (pro parte).

D^1. I. 4—6; D^2. I. 10—11 (12); A. I. 19—22; P. I. 13; V. 1.5; L.l. 30—33; L.tr. 12—13.

Dorsal profile convex between occiput and first dorsal, less so in young specimens. Upper profile of head concave. Ventral profile convex. Height 2.3—3, 3.2—3.8 in length with caudal. Head 3.3—3.7, 4.5 to nearly 5 in length with caudal. Eye

more or less than 3, about equal to snout and almost 1.5 in interorbital space. Mouth with a gentle downward curve when seen in front, the upper jaw fitting into a sinuation of the lower jaw. Lower jaw slightly prominent. Mouthopening reaching to about middle of length of snout. Small teeth in jaws, only near symphysis in more than one series. Small teeth on vomer, a few on palatines and on base of tongue. Subocular part of cheeks with one row of scales anteriorly, two rows posteriorly. Large scales on operculum, excepting the superior ones, which are smaller. First dorsal separated by 16—19 scales from occiput. Spine of first dorsal about equal to postorbital part of head, longer than anal spine and about as long as that of second dorsal, which is thicker. Origin of anal opposite to that of first dorsal. Length of base of anal about equal to distance between origin of first dorsal and end of second dorsal. Pectorals curved, as long as head without snout. Caudal peduncle as high as long or higher than long. Scales slightly crenulated behind. Colour of alcohol specimens brownish yellow above, lighter below. Scales lighter in the middle, by which a reticulated aspect is produced, especially distinct on the caudal peduncle, where the longitudinal rows of scales are separated by black stripes. Fins dusky. Second dorsal, anal and caudal chequered with dusky and white. Length 100 mm.

Habitat: South New Guinea (Merauke!).

In freshwater-marshes and ditches.

5. **Melanotaenia ogilbyi** M. Web. [Fig. 78, p. 288].

Melanotaenia Ogilbyi Max Weber, Notes Leyden Mus. XXXII. 1911, p. 230. — Nova Guinea IX. Livr. 4, 1913, p. 560.

Melanotaenia nigrans Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 279 (pro parte).

D^1. I. 4—6; D^2. I. 11 (12); A. I. 17—18 (19); P. I. 11; V. 1.5; L.l. 34—36; L.tr. $10^1/_2$.

Rather elongate, upper and lower profile not much convex. (Only small specimens are known). Height 2.7—3, 3.4—3.8 in length with caudal. Head 3.6—3.9, 4.5—4.8 in length with caudal. Eye more or less than 3, equal to or somewhat longer than snout and about 1.3 in interorbital space. Mouthopening with a gentle downward curve when seen in front, the upper jaw fitting into a sinuation of the lower jaw. Jaws equal. Mouthopening reaching almost to vertical through frontborder

of eye. Small teeth in jaws, vomer and base of tongue. Subocular part of cheeks with two rows of scales, posteriorly 3 rows. Large scales on operculum, excepting the superior ones, which are smaller. First dorsal separated by 16—17 scales from occiput. Spine of first dorsal slender, almost as long as snout and eye together, longer than that of second dorsal, which is more curved and much longer than that of anal, which is about equal to eye. Length of base of anal about equal to distance between beginning of first dorsal and end of second dorsal. Origin of first dorsal somewhat in front of that of anal. Pectorals curved, as long as head without snout. Caudal peduncle longer than high. Scales slightly crenulated behind. Colour of alcohol specimens brownish above, light yellow below, the two colours separated by a dark longitudinal band, having the breadth of two scales, and running from operculum to base of caudal. The longitudinal rows of scales below it are separated by narrow dark stripes, which are more or less distinct. Fins more or less dusky, with a darker marginal border. Sometimes a row of black spots at base of anal (males?). Length 68 mm.

Habitat: South New Guinea (marshes along Lorentz river!).

Freshwater.

Doubtful species.

6. **Melanotaenia loriae** (Perugia).

Aristeus Loriae Perugia, Ann. Mus. Civ. Genova (2) XIV. 1894, p. 549.
Rhombatractus loriae Douglas Ogilby, Proc. Linn. Soc. N. S. Wales XXI. prt. 2, 1896, p. 134.

D^1. I. 5; D^2. I. 13; A. I. 22; L.l. 28.

"Height $2^1/_3$ in total length. Head 4 in total length. Eye little less than $^1/_3$ of head, which is strongly flattened. The interorbital space is $1^1/_3$ diameter of eye. The arcuate profile gives to the body an almost perfectly oval shape. The second dorsal has the rays prolonged; when bent backwards they surpass the middle of the caudal. Colour of alcohol specimens mahogony on the back, golden on the sides, with 7 straight longitudinal bands. The fins are hyaline, with a narrow black border. Length 110 mm." [After PERUGIA, not seen by us].

Habitat: South New Guinea (Inawi).

Freshwater.

Note. TATE REGAN, who examined a specimen of this species, united it with *M. nigrans* Rich. As however REGAN unites a number of species under this name, which according to us have the value of separate species, we don't know where to place it, as PERUGIA'S description is too short. If there were really only 28 scales in the L.l., the species would easily be distinguishable, but we suppose this is a misprint, as otherwise REGAN would not have united it with *M. nigrans*, for which he gives: L.l. 33—37.

7. **Melanotaenia** (?) **rubrostriata** Ramsay & Ogilby.

Nematocentris rubrostriatus Ramsay & Douglas Ogilby, Proc. Linn. Soc. N. S. Wales 2. I. 1886, p. 14.

Rhombatractus rubrostriatus Douglas Ogilby, Proc. Linn. Soc. N. S. Wales XXI. (part 2) 1896, p. 134.

? *Anisocentrus rubrostriatus* Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 281 (pro parte).

D^1. I. 5; D^2. I. 11; A. I. 20; V. 1.5; P. 11; C. 16; L.l. 32; L.tr. 11; Vert. 33.

"Length of head $4^1/_2$, of caudal fin 5, height of body $3^2/_5$ in the total length. Eyes large, their diameter $2^3/_5$ in the length of the head, $^4/_5$ of a diameter from the end of the snout, and one diameter apart. Upper jaw slightly overhanging the lower; maxilla does not reach to the front margin of the eye. Profile in front of the first dorsal straight, or if anything slightly convex. Both jaws entirely covered with closely set short sharp recurved teeth; a similar patch on the head of the vomer. The rays of the second dorsal are equal in height to those of the first which are not filamentous: the anal commences behind the origin of the first dorsal fin. Ventrals inserted far behind the base of the pectorals: caudal forked. Scales with crenulated edges, covering the cheeks, opercles and upper part of the head to the middle of the interorbital space; the anterior occipital scales large and prominent; there are 15 scales in front of the first dorsal fin. Colors, silvery, with nine broad red longitudinal bands: the dorsals and anal dusky washed with red, the second dorsal having a basal row of brilliant crimson spots. The specimen measures ± 69 mm." [After RAMSAY and DOUGLAS OGILBY, not seen by us].

Habitat: New Guinea (Strickland river).

Note. It is impossible to give this species even its correct generic position after the short description of the authors. As OGILBY, one of the authors, placed the species later on (vide syn.) in the genus *Rhombatractus*, we don't know why TATE REGAN united it with *M. dumasi* under the name of *Anisocentrus rubrostriatus*. He did not see typical specimens and based his description on two co-types of *M. dumasi* and on 5 specimens from the Setakwa-River. Moreover he gives as habitat: Aru-Islands; we don't know on whose authority. Later on (Proc. Zool. Soc. 1914, p. 339) TATE REGAN got informations about the type of the species from MC CULLOCH and writes: "the type of *N. rubrostriatus* Rams. & Ogilb. is damaged about the mouthparts; a figure of the upper jaw is sufficient to indicate that examples I have recently described as belonging to this species, are correctly determined." As the origin of the dorsal is situated above or somewhat behind that of anal in *M. dumasi*, whereas it is — according to the authors — before that of anal in *N. rubrostriatus*, we think it safer to keep them apart, till lastnamed species is better known.

2. **Rhombatractus** Gill (Weber).

(GILL, American Naturalist 1894, p. 709;
MAX WEBER, Nova Guinea V. Livr. 2, 1908, p. 233).
Rhombosoma Tate Regan, Trans. Zool. Soc. London XX. part 6, 1914, p. 283.

Much compressed, oblong, the height increasing with age. The dorsal profile sloping gently upwards from head to dorsal in small specimens, usually much elevated and convex in old specimens. Ventral profile convex, much so in old specimens. Upper jaw the longer. Mouth comparatively large, reaching to vertical through frontborder of eye or nearly so. Intermaxillaries with an abrupt bent between their horizontal and lateral part. Lips thickened. Pointed conical teeth in several rows in the jaws, extending to the outside of the lips. A patch of teeth on vomer. Teeth on palatines more or less conspicuous, teeth on base of tongue present or absent. First dorsal with one spine and 3—5 flexible rays. Second dorsal with one spine and 11—17 soft rays. Anal with a weak spine and 18—30 soft rays. Origin of anal in advance of that of first dorsal, below it or somewhat behind it. Ventrals with a slender spine and 5 soft rays, beginning somewhat behind origin of pectorals, which have no

spine. Caudal forked. Scales smooth or with faint crenulations at their hindborder, moderate, 32—39 in a row between head and caudal. Lateral line absent or indicated by some scales having a shallow pit. Six branchiostegals.

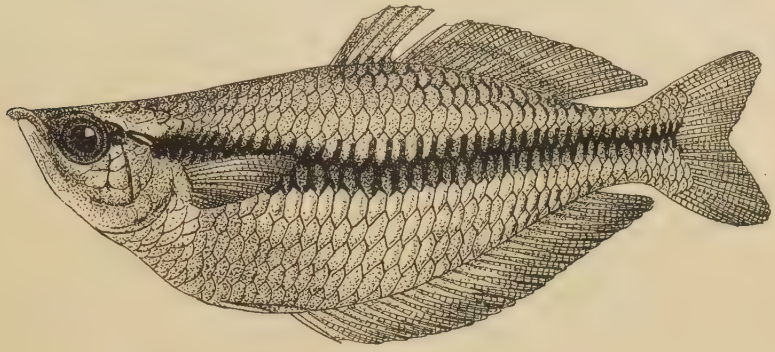


Fig. 79. *Rhombatractus kochi* M. Web. × 3/4.

Distribution: Freshwater of New Guinea, Waigeu and Aru Islands.

Note: The genus *Rhombosoma* Tate Regan (Trans. Zool. Soc. London XX. prt 6, 1914, p. 283) is synonymous with *Rhombatractus* as described by M. Weber (Nova Guinea V. Livr. 2, 1908, p. 233). Regan substituted the new name on the following reasons: Gill created the name *Rhombatractus* to replace Castelnau's name *Aristeus*, which was preoccupied. The species described by Castelnau, and which is the type of *Aristeus* Castelnau, is *Aristeus fitzroyensis*. According to Regan *A. fitzroyensis* is a *Melanotaenia*; *Rhombatractus* is therefore synonymous with *Melanotaenia*, which name is the older. Douglas Ogilby (Proc. Linn. Soc. N. S. Wales 1896, p. 125) is of the same opinion. Gill however (Amer. Naturalist 1894, p. 709), in creating the name *Rhombatractus*, does not mention a type, but says that it is a substitute for the group called *Aristeus* by Castelnau. The diagnosis of *Rhombatractus*: "Melanotaeniines with a much compressed rhombofusiform body, emarginate dorsal-rostral contour, and no distinct lateral band" is appliable as well to older specimens of *Melanotaenia* as of *Rhombatractus*. There is therefore in our diagnosis, giving above, nothing against the use of the genus name *Rhombatractus* in the sense of M. Weber for those species, which later are called *Rhombosoma* by Regan.

Key to the indo-australian species of Rhombatractus.

I. Lower jaw somewhat prominent. L.l. 30—32. Origin of anal opposite to that of first dorsal. Anal with 17—21 rays. Pectorals shorter than head without snout. *Rh. praecox* p. 298.

II. Upper jaw prominent. L.l. 32—40.

A. Second dorsal with 18—21 rays. L.l. 38—40. Origin of anal in front of first dorsal. Pectorals equal to head without snout. A vertical black band between black lateral band and base of anal . . . . . *Rh. vanheurni* p. 299.

B. Second dorsal with less than 18 rays. L.l. with less than 40 scales. Origin of anal in front of, opposite to or somewhat behind that of first dorsal. Pectorals longer than head without snout. No vertical black band.

1. L.l. 37—39. Origin of anal decidedly in front of that of first dorsal. 17—19 praedorsal scales.

a. Dorsal profile convex. Caudal peduncle as high as long or higher than long. Second dorsal with 15—17 rays. A. I. 23—30. . . . *Rh. lorentzi* p. 300.

b. Dorsal profile straight or even concave. Caudal peduncle longer than high, in very large specimens as high as long. Second dorsal with 11—14 rays. A. I. 21—25 . . . . . *Rh. kochi* p. 302.

2. L.l. 32—36. Origin of anal below or slightly before or behind that of first dorsal. 15—16 praedorsal scales.

a. Caudal peduncle considerably higher than long, longer than high in small specimens. Snout shorter, more obtuse. Second dorsal with 11—13 rays. No teeth on tongue. Spine of first dorsal much shorter than that of anal. *Rh. catherinae* p. 303.

b. Caudal peduncle as long as high, higher than long in very large, longer than high in small specimens. Snout longer, more pointed. Second dorsal with 12—16 rays. A patch of teeth on base of tongue. Spine of first dorsal much longer than that of anal . . . . . *Rh. goldiei* p. 304.

1. Rhombatractus praecox n. sp.

D^1. I. 3—5; D^2. I. 10—14; A. I. 17—21; P. 11—13; V. I.5; L.l. 30—32; L.tr. 11—12.

Dorsal and ventral profile convex, somewhat less so in very small specimens. Height 2.1—2.9, 2.8—3.7 in length with caudal. Head 3.4—3.8, 4—4.5 in length with caudal. Eye 2.7—3.2, equal to or somewhat more than snout, 1.2—1.3 in postorbital part of head, which is equal to or slightly longer than interorbital space. Lower jaw somewhat prominent. Mouth-opening not reaching quite to vertical through frontborder of eye. Lips not thickened, except somewhat at symphysis of jaws. Very small teeth in several rows on jaws, extending on outside of lips on vomer and (?) on palatines. Tongue smooth. One row of scales on suborbital part of cheeks. Operculum with large scales excepting the superior ones, which are small. Dorsal separated by 14—16 scales from occiput. Spine of first dorsal equal to or slightly longer than postorbital part of head, longer than spine of second dorsal, which is again longer than anal spine. Origin of anal opposite to that of first dorsal. Length of base of anal longer than distance between origin of first dorsal and end of second dorsal. Pectorals somewhat shorter than head without snout. Scales smooth or with faint crenulations at their hindborder. Caudal peduncle longer than high in small specimens, as high as long in larger specimens. Colour of preserved specimens brownish, darker above. A faint narrow blackish longitudinal band is sometimes visible. Fins dusky. In some specimens the second dorsal and the anal have a red marginal band and the ventrals are also tinged with red. Length 61 mm.

Habitat: North New Guinea (Mamberamo-river!), collected by Jhr. W. C. VAN HEURN.

Note. A remarkable pecularity of this species is, that the elevated rhombic form is attained at a much smaller size than in all other species of Melanotaeniinae known to us.

2. **Rhombatractus vanheurni** n. sp.

D^1. I. 4—5; D^2. I. 18—21; A. I. 24—26; P. I. 13—14; V. I. 5; L.l. 38—40; L.tr. 12—13.

Dorsal and ventral profile evenly convex in the young, when older the back is more arched and the greatest convexity of the ventral profile more forward, so that the form of the fish is more rhombic. Height 2.7—3.2, 3.1—3.9 in length with caudal. Head 3.4—3.7, 4.1—4.3 in length with caudal. Eye 3.4—4.8 in head; 1.2 (in small specimens) to nearly twice

(in large specimens) in snout, which is somewhat more than interorbital space and about equal to postorbital part of head. Upper jaw prominent. Mouthopening reaching to vertical through frontborder of eye in young specimens, in older ones not so far. Pointed conical teeth in several rows in the jaws, extending on the lips, which are swollen, especially in their anterior part. An elongate patch of teeth on vomer, a smaller one on each palatine and on tongue. Three to four rows of scales on subocular part of cheeks. Operculum with large scales, the superior rows much smaller. Dorsal separated by 15—17 scales from occiput. Spine of first dorsal somewhat shorter than or (in young specimens) equal to postorbital part of head; much longer than that of second dorsal. Spine of anal about as long as that of second dorsal and equal to eye. Origin of first dorsal slightly, to one eye-diameter in front of origin of anal. Length of base of anal only slightly less than distance between origin of first dorsal and end of second dorsal. Length of pectorals equal to head without snout. Scales with faint crenulations along the hindborder. Height of caudal peduncle 1.2 in its length, 1.5 in young specimens. Colour of formol-alcohol specimens yellowish, anterior part of back dark, a black lateral band, widening posteriorly, from snout, through eye to middle of base of caudal. A more or less well developed vertical black band runs from the lateral one to the base of anal. Often a few narrower bands, parallel to the vertical one, before or behind it. Operculum with a bluish black patch below the lateral band. Fins more or less dusky, often with a pink hue, probably the remains of a brighter colouring during life. Length 160 mm. [1]).

Habitat: North New Guinea (Idenburg river!, Doorman river!).

3. **Rhombatractus lorentzi** M. Web. [Fig. 80, p. 301].

Rhombatractus Lorentzi Max Weber, Nova Guinea V. Livr. 2, 1908, p. 236. — Ibid. IX. Livr. 4, 1913, p. 564.

Rhombosoma lorentzii Tate Regan, Trans. Zool. Soc. London XX. prt. 6, 1914, p. 284.

D^1. I. 4—5; D^2. I. 15—17; A. I. 23—30; P. 1.14; V. I. 5; L.l. 38; L.tr. 12—13.

Dorsal profile sloping down from dorsal to occiput in a slightly

1) We have the pleasure to dedicate this species to Jhr. W. C. van Heurn, the indefatigable Zoologist of the dutch North New Guinea Expedition (Mamberamo Expedition) of 1920—1921.

convex line in young specimens, stronger convex in old specimens, with a concavity behind head. Height 2.3—3.2, 2.7—4 in length with caudal. Head 3.4—3.9, 4—4.8 in length with caudal. Eye 3.5—4.1, about 1.5 in snout, which is equal to interorbital space and somewhat less than postorbital part of head. Upper jaw prominent. Mouthopening reaching almost or entirely to vertical through frontborder of eye. Pointed, conical teeth in several rows in the jaws, extending to the lips, which are thickened, especially in their anterior part. A large patch of teeth on vomer, on palatines and on base of tongue. Three to four rows of scales on subocular part of cheeks. Operculum with large scales, excepting the superior ones, which are small. Dorsal separated by 18—19 scales from occiput. Spine of first dorsal somewhat shorter than or equal to post-

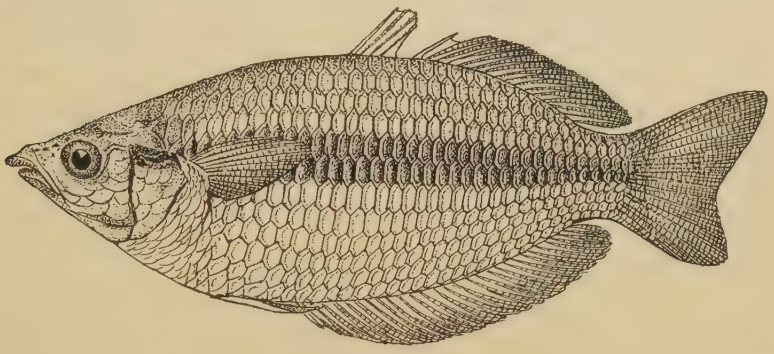


Fig. 80. *Rhombatractus lorentzi* M. Web. × 7/8.

orbital part of head, much longer or as long as that of second dorsal, which is slightly or much longer than that of anal. Anal spine equal to or longer than eye. Origin of anal about the length of snout in advance of origin of first dorsal. Length of base of anal much longer than distance between origin of first dorsal and end of second dorsal. Pectorals somewhat longer than head without snout. Scales nearly smooth or with faint crenulations along the hindborder. Caudal peduncle as high as long or higher than long. Colour of alcohol specimens light brownish above, silvery white below, sometimes with a partly developed lateral band, which is at least as broad as one scale. Fins somewhat dusky. Length 142 mm.

Habitat: North New Guinea (rivers Sermowai!, Tawarin! and Mamberamo!).

4. Rhombatractus kochi M. Web. [Fig. 70, p. 297].

Rhombatractus Kochii Max Weber, Nova Guinea V. Livr. 2, 1908, p. 237. — Nova Guinea IX. Livr. 4, 1913, p. 562.

Rhombosoma novae-guinea Tate Regan, Trans. Zool. Soc. XX. Part 6, 1914, p. 283 (pro parte).

D^1. I. 4—5; D^2. I. 11—14 (15); A. I. 21—25; P. 1.14; V. I. 5; L.l. 37—39; L.tr. 11—14.

Dorsal profile in young and middle sized specimens nearly a straight line, sloping from dorsal to snout, in large specimens with a concavity at nape. Ventral profile convex or very convex. Height 2.3—3.4, 2.7—4.3 in length with caudal. Head 3.4—4, 4.3—4.9 in length with caudal. Eye 3—4, shorter or much shorter than snout, more or less than 1.5 in interorbital space, which is equal to or shorter than postorbital part of head. Upper jaw prominent. Mouthopening reaching to frontborder of eye or not so far in large specimens. Curved conical teeth in several rows in the jaws, extending on the outside of the lips, especially in their anterior part, which is thickened. A transverse patch of teeth on vomer. Teeth on palatines and on base of tongue. Two or three rows of scales on the subocular part of the cheeks. Large scales on operculum, small ones on its superior part. Dorsal separated by 17—19 scales from occiput. Spine of first dorsal shorter or longer than postorbital part of head, longer than that of second dorsal and much longer than that of anal, which is equal to or shorter than eye. Length of base of anal longer than distance between origin of first dorsal and end of second dorsal. Origin of anal 2—4 scales in front of that of first dorsal, less in small specimens. Pectorals longer than or equal to head without snout. Scales nearly smooth or somewhat crenulated at their hindborder. Caudal peduncle longer than high, in very large specimens as high as long or even somewhat higher than long. Colour of alcohol specimens brownish above, yellowish below, the two colours separated by a longitudinal dark band, which has the breadth of about two scales and runs from behind eye to caudal peduncle. It is often indistinct or interrupted in the middle. Second dorsal and anal with a marginal and a basal darker band. Other fins more or less dusky. Length 177 mm.

Habitat: Dutch South New Guinea (Merauke river!, Lorentz river!, Beaufort river!, brook at Etna Bay!).

Freshwater.

5. Rhombatractus catherinae de Bfrt.

Rhombatractus catherinae de Beaufort, Zool. Anz. XXXVI. 1910, p. 250. — Bijdragen tot de Dierkunde Afl. 19, Amsterdam, 1913, p. 106.

Rhombosoma novae-guineae Tate Regan, Trans. Zool. Soc. XX. Part. 6, 1914, p. 283 (pro parte).

D^1. I. 3—5; D^2. I. 11—13; A. I. 19—23; P. 1. 12—13; V. I. 5; L.l. 32—35; L.tr. 12 ($11^1/_2$).

Dorsal profile nearly straight, sloping down from dorsal to snout, a little more convex in large specimens. Ventral profile strongly convex in large specimens. Height in smaller specimens (to 100 mm.) 2.5—3.2, 3—3.75 in length with caudal, in specimens above 100 mm. 2.2—2.5, 2.7—3 in length with caudal. Head 3.2—3.7, 4—4.5 in length with caudal. Eye 3—3.8, about 1.5 in interorbital space, which is about equal to postorbital part of head. Snout rather obtuse, 2.6—3 in head and only a little longer than eye. Upper jaw prominent. Mouthopening reaching to vertical through frontborder of eye. Conical teeth in several rows in the jaws, extending to the outside of the lips, which are thickened, especially in their anterior part. A patch of teeth on the vomer and perhaps a few on the hinderpart of the palatines, none on tongue. Two rows of scales on suborbital part of cheeks. Operculum with large scales, excepting the superior ones, which are small. Dorsal separated by 16 scales from occiput. Spine of first dorsal scarcely longer than that of second dorsal, shorter than postorbital part of head and much shorter than that of anal, which is about equal to eye. Origin of anal opposite to that of first dorsal. Length of base of anal longer than distance between origin of first dorsal and end of second dorsal. Pectorals longer than head without snout. Scales nearly smooth, with indication of crenulations. Caudal peduncle longer than high in small specimens, in large specimens considerably higher than long. Colour of alcohol specimens brown or yellowish brown on the back, ventrally yellow or whitish. A broad black lateral band, at least as broad as one scale, runs from the hindborder of the eye over the base of the pectoral to the caudal. Fins dusky, base of second dorsal and anal darker. In life the lateral band is dark-blue and the scales have wine-red margins, which form about 8 longitudinal stripes. Proximal part of anal and second dorsal wine-red. Length 119 mm.

Habitat: Waigeu!.

Freshwater.

6. Rhombatractus goldiei (Macleay).

Aristeus goldiei Macleay, Proc. Linn. Soc. N. S. Wales VIII. 1883, p. 269.
? *Nematocentris novae-guineae* Ramsay & Douglas Ogilby, Proc. Linn. Soc. N. S. Wales 2. I. 1886, p. 13.
Aristeus Goldiei Perugia, Ann. Mus. Civ. Genova (2) XIV. 1894, p. 548.
Rhombatractus goldiei Douglas Ogilby, Proc. Linn. Soc. N. S. Wales XXI. part 2, 1896, p. 134.
? *Rhombatractus novae-guineae* Ogilby, Proc. Linn. Soc. N. S. Wales XXI. part 2, 1896, p. 134.
Rhombatractus affinis Max Weber, Nova Guinea V. Zool. Livr. 2, 1908, p. 234. — ibid. IX. Livr. 4, 1913, p. 565.
Rhombatractus weberi Tate Regan, Ann. Mag. Nat. Hist. (8) I. 1908, p. 155.
Rhombatractus senckenbergianus Max Weber, Abh. Senckenb. Naturf. Gesell. XXXIV. 1911, p. 25.
Rhombosoma navae-guineae Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 283 (pro parte).
Rhombosoma goldiei Tate Regan, Proc. Zool. Soc. London 1914, p. 339.

D^1. I. 4—5; D^2. I. 12—16; A. I. 18—24; P. 1. 14; V. I. 5; L.l. 34—36; L.tr. 11—12.

Dorsal profile a nearly straight line, sloping from dorsal to snout, in older specimens somewhat concave behind head. Ventral profile convex or very convex. Height 2.5—3.1, 2.9—3.8 in length with caudal. Head 3.2—3.5, 4 or somewhat more in length with caudal. Eye 3—4, shorter or much shorter than snout, which is about equal to postorbital part of head and to interorbital space. Upper jaw prominent. Mouthopening reaching to frontborder of eye or not so far in larger specimens. Curved conical teeth in several rows in the jaws, extending on the outside of the lips, especially in their anterior part, which is thickened. A transverse patch of teeth on vomer. Few teeth on palatines. A patch of teeth on base of tongue. Two or three rows of scales on suborbital part of cheeks. Large scales on operculum, smaller ones on their superior part. Dorsal separated by 15—16 scales from occiput. Spine of first dorsal about equal to postorbital part of head, longer than that of second dorsal, and much longer than that of anal, which is about equal to eye. Length of base of anal equal to or slightly longer than distance between origin of first dorsal and end of second dorsal. Origin of anal below, somewhat before or somewhat behind that of first dorsal. Pectorals curved, somewhat longer than head without snout. Scales slightly crenulated at their hindborder. Caudal peduncle as high as long or somewhat higher than long in large specimens, longer than

high in smaller specimens. Colour of alcohol specimens brownish above, lighter and more or less silvery below, the two colours separated by a longitudinal black band, which has the breadth of about two scales and runs from behind eye to middle of base of caudal; it is generally broader and more distinct in its posterior part. Above the anal a more or less distinct second band, parallel to the first and sometimes only indicated by a black patch or totally absent. Fins more or less dusky, base of second dorsal and anal generally darker. Length 135 mm.

Habitat: New Guinea (rivers Tĭmena!, Sekanto!, Bégowri!, Sermowai!, river near Njao!, river Wagami!, river Mimika, Strickland and Goldie river, Sageri); Aru-Islands!.

Note. Specimens from the Aru-Islands (*R. senckenbergianus*) seem to be a little more elongate. Height 3.5—3.75, more than 4—4.5 in length with caudal. As the largest specimen known from the Aru-Islands is 92 mm. and considering the well known variability in the height of these fishes, we don't think the difference sufficient to keep them apart.

3. **Centratherina** Tate Regan.

(Tate Regan, Trans. Zool. Soc. London XX. prt. 6, 1914, p. 283).

Much compressed, elongate. Dorsal profile sloping down in an almost straight line to snout. Ventral profile convex. Head rather pointed, flat above. Upper jaw prominent. The inter-

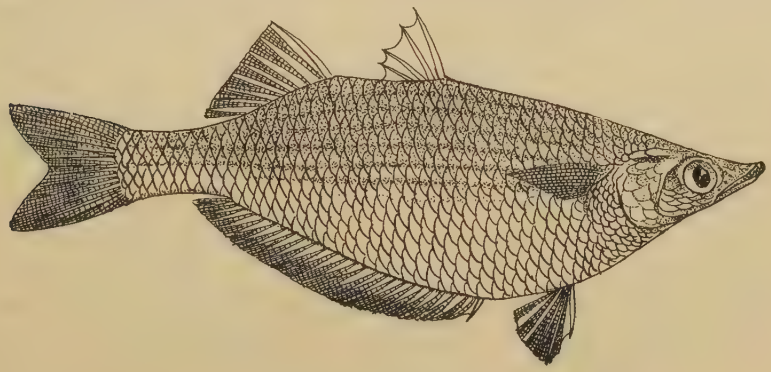


Fig. 81. *Centratherina crassispinosa* (M. Web.) × 3/4.

maxillaries are gently curved, without abrupt bent between their horizontal and the lateral part. Lips thickened. Jaws with several rows of pointed teeth, extending to the outside of the

lips. Palate and tongue toothless. First dorsal consisting of 4 or 5 spines, the first of which is by far the stronger. Second dorsal with a spine and 8—11 rays. Anal with a weak spine and 23—26 divided rays. Origin of anal well in advance of that of first dorsal. Ventrals with a slender spine and 5 soft rays, beginning somewhat behind origin of pectorals, which have no spine. Caudal forked. Scales nearly smooth, 40—44 in a row between head and caudal. Lateral line absent. Five (?) branchiostegals.

Distribution: Freshwater of Northern New Guinea.

1. **Centratherina crassispinosa** (M. Web.) [Fig. 81, p. 305].

Rhombatractus crassispinosus Max Weber, Nova Guinea IX. Livr. 4, 1913, p. 567.
Centratherina crassispinosa Tate Regan, Trans. Zool. Soc. London XX. prt. 6, 1914, p. 283.

D^1. IV—V; D^2. I. 8—12; A. I. 23—26; P. I. 13—14; V. I. 5; L.l. 40—44; L.tr. $12^1/_2$—13.

Height 3—3.2, 3.6—4.2 in length with caudal. Head 4—4.3, 4.8—5.2 in length with caudal. Eye 3.3—4, shorter than snout, which is equal to interorbital space but shorter than postorbital part of head. Mouthopening not reaching to frontborder of eye. Three to four rows of scales on suborbital part of cheeks. Scales on operculum large, excepting the superior ones, which are small. Dorsal separated from occiput by 21—26 scales. First spine of first dorsal stronger than the other ones, as long as, somewhat shorter or longer than that of second dorsal, which is curved and thicker than those of first dorsal and about as long as head without snout or as postorbital part of head. Anal spine much weaker, not much longer than eye. The origin of the anal is 4—6 (in large specimens 2) scales in front of that of dorsal. Pectorals somewhat falciform, as long as head without snout. Scales nearly smooth. Caudal peduncle slender, considerably longer than high. Colour of alcohol specimens light brownish, yellowish below with a silvery hue. Traces of a lateral dark band. Fins hyaline or dusky, upper and lower border of caudal more or less blackish. Length 127 mm.

Habitat: North New Guinea (river Tawarin!, river Sermowai!, Kaiserin Augusta-river!).

Fresh water.

4. Chilatherina Tate Regan.

(Tate Regan, Trans. Zool. Soc. London XX. prt 6, 1914, p. 282).

Much compressed, oblong. Dorsal profile strongly elevated and convex in old specimens, less so in young ones. Ventral profile much convex. Head rather pointed. Upper jaw more or less prominent. The intermaxillaries are gently curved, without abrupt bent between the horizontal and the lateral part. Lips more or less thickened, especially the upper lip. Jaws with several rows of pointed teeth, reduced to one row laterally. Teeth on vomer and base of tongue; those on palatines absent or present. First dorsal with a spine and 3—5 soft undivided rays. Second dorsal with one curved spine and 10—16 soft rays. Anal with a weak spine and 22—25 soft rays.

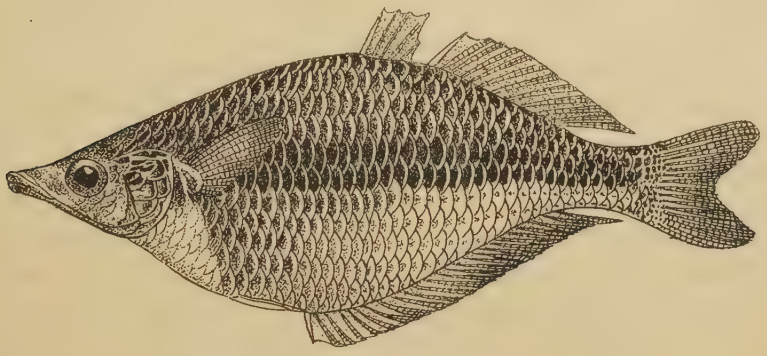


Fig. 82. *Chilatherina sentaniensis* (M. Web.) × 9/10.

Origin of anal in advance of that of first dorsal. Ventrals with a slender spine and 5 soft rays, beginning somewhat behind origin of pectorals, which have no spine. Caudal deeply forked. Scales smooth or indistinctly crenulated at their hindmargin; rather small, 40—42 in a row between head and caudal. Lateral line absent or indicated by some scales having a shallow pit. Six branchiostegals. About 14 short gillrakers on the lower part of the anterior arch.

Distribution: Freshwater of Northern New Guinea.

Key to the indo-australian species of Chilatherina.

1. Head 4.3—5.8. 19—21 scales in front of dorsal. 13—16 soft dorsal rays . . . . . *Ch. fasciata* p. 308.
2. Head less than 4. 22—27 scales in front of dorsal. 10—12 soft dorsal rays . . . . . *Ch. sentaniensis* p. 309.

1. Chilatherina fasciata (M. Web.).

Rhombatractus fasciatus Max Weber, Nova Guinea IX. Livr. 4, 1913, p. 565.
Chilatherina fasciata Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 282.

D^1. I. 4—5; D^2. I. 13—16; A. I. 23—25 (26); P. 1. 14—15; V. 1.5; L.l. 40—42; L.tr. 12—13.

Dorsal profile somewhat convex behind nape; ventral profile strongly convex. Head pointed. Height 3—5.3, 6—6.3 in length with caudal. Head 4.3—5.8, 5.2—7.2 in length with caudal. Eye 3—3.2, somewhat less than interorbital space, which is about equal to snout. Upper jaw prominent. Mouthopening reaching behind middle of length of snout, but not to front-border of eye. Maxillary not visible when the mouth is closed. Upper lip thickened. Jaws with several series of strong pointed teeth anteriorly, diminishing in number posteriorly, forming a single series on the lateral part of the intermaxillaries and extending outside the mouth on the upper lip and less so on the lower lip. The intermaxillaries are gently curved, not abruptly bent from a horizontal into a lateral oblique part. Small teeth on vomer and on base of tongue. None on palatines. Two, and posteriorly three rows of scales on subocular part of cheeks. Large scales on operculum, smaller ones on its superior part. First dorsal separated by 19—21 scales from occiput. Spine of first dorsal longer than postorbital part of head, longer than that of second dorsal, which is more curved and much longer than that of anal, which is about as long as eye. Length of base of anal considerably longer than distance between origin of first dorsal and end of second dorsal. Origin of anal beginning 2—4 scales before that of first dorsal. Pectorals curved, equal to or longer than head without snout. Scales smooth or indistinctly crenulated at their hindborder. Caudal peduncle much longer than high. Colour of alcohol specimens brownish above, lighter below, with a more or less distinct longitudinal black band and a series of transverse narrow bands, forming about right angles with the longitudinal band in the lower half of the body. These bands are sometimes obsolete. Fins dusky. Length 131 mm.

Habitat: Northern New Guinea (Mamberamo! and Idenburg river!, river Sermowai and its tributaries!, river near Njao!, tributary of Kaiserin Augusta river!).

Fresh water.

2. Chilatherina sentaniensis (M. Web.) [Fig. 82, p. 307].

Rhombatractus sentaniensis Max Weber, Nova Guinea V. Livr. 2, 1908, p. 235. — Nova Guinea IX. Livr. 4, 1913, p. 564.
Chilatherina sentaniensis Tate Regan, Trans. Zool. Soc. London XX. Part 6, 1914, p. 282.

D^1. I. 3—4; D^2. I. 10—12; A. I. 22—24; P. 1. 12; V. 1.5; L.l. 41—42; L.tr. 13.

Dorsal profile somewhat convex behind nape; ventral profile strongly convex. Head pointed. Height 2.4—3.3, 2.7 to 4 in length with caudal. Head somewhat more or less than 3.5, 3.9—4.3 in length with caudal. Eye 3.5 to nearly 4, nearly 1.5 in snout, which is somewhat longer than interorbital space. Upper jaw slightly prominent. Mouthopening reaching behind middle of length of snout, but not to frontborder of eye. Anterior end of maxillary generally visible, when the mouth is closed. Jaws with several rows of pointed teeth extending anteriorly to the outside of the lips, which are thickened. Small teeth on vomer, palatines and on base of tongue. The intermaxillaries are gently curved, without abrupt bent between their horizontal and the lateral part. Two rows of scales on postocular part of cheeks. Large scales on operculum, smaller ones on its superior part. First dorsal separated by 22—27 scales from occiput. Spine of first dorsal longer than that of second dorsal, much longer than that of anal, which is shorter than eye. Length of base of anal much more than distance between origin of first dorsal and end of second dorsal. Origin of first dorsal about 5—6 scales behind that of anal. Pectorals curved, as long as head without snout. Scales smooth or indistinctly crenulated. Caudal peduncle longer or much longer than high. Colour of alcohol specimens reddish brown above, silvery below, with a more or less distinct longitudinal black band and sometimes with narrow cross-bars on the lower half of the body. Fins blackish. Length 110 mm.

Nom. indig.: Séu (Lake Sentani).

Habitat: North New Guinea (Lake Sentani!, river Sekanto!). Fresh water.

5. Glossolepis M. Weber.

(M. Weber, Nova Guinea V. Livr. 2, 1908, p. 241).

Much compressed, oblong. The dorsal profile much elevated

behind head, convex, especially in older specimens. Ventral profile convex. Upper jaw very slightly prominent. Intermaxillaries with an abrupt bent between their horizontal and lateral part. Lips not thickened. Mouthopening moderate, not reaching to vertical through frontborder of eye. Jaws with several rows of conical, rounded teeth, which extend somewhat on the lips, especially near symphysis of intermaxillaries. Vomer

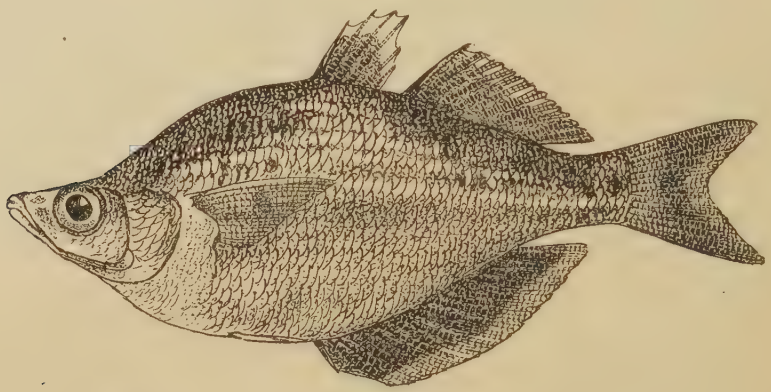
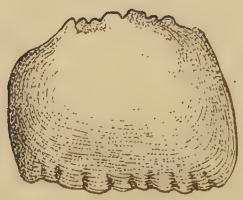


Fig. 83. *Glossolepis incisus* M. Web. n. s. With figure of a magnified scale.



with a transverse band of teeth. A band of teeth on palatines and on tongue. First dorsal with one strong spine and 3—5 much weaker ones. Second dorsal with a rather long curved spine and 9—10 rays. Anal with a weak spine and 20—23 rays, its origin before that of first dorsal. Ventrals with a slender spine and 5 rays, originating slightly behind origin of pectorals. Pectorals without spine. Caudal deeply forked. Scales irregularly arranged, deeply crenulated along their hindmargin, rather small, 55—60 between head and tail. No lateral line. Six branchiostegals. About 30 rather long and slender gillrakers on the lower part of the anterior arch.

Distribution: Northern New Guinea.

Fresh water.

1. **Glossolepis incisus** M. Web. [Fig. 83, p. 310].

Glossolepis incisus M. Weber, Nova Guinea V. Livr. 2, 1908, p. 241. — Ibid. IX. Livr. 4, 1913, p. 562.

Glossolepis incisus Tate Regan, Trans. Zool. Soc. London XX. prt 6, 1914, p. 281.

D^1. IV—VI; D^2. I. 9—10; A. I. 20—23; P. 1. 14; V. I. 5; L.l. 55—60; L.tr. circa 17.

Height 2.3—2.8, 2.9—3.4 in length with caudal. Head 3.3—4, 4—5 in length with caudal. Eye 2.5 to more than 3, longer than or equal to snout, which is equal to or somewhat shorter than slightly concave interorbital space and considerably shorter than postorbital part of head. Mouthopening reaching farther back than middle of length of snout. Three rows of scales on subocular part of cheeks. Dorsal separated by 40—42 scales from occiput. First spine of first dorsal longer or shorter than that of second dorsal, longer than or equal to postorbital part of head. Anal spine as long as eye. Origin of first dorsal somewhat behind that of anal. Pectorals somewhat falciform, considerably longer than head without snout. Caudal peduncle much longer than high. Reddish brown, with a silvery hue, fins blackish in their proximal part. Length 145 mm.

Habitat: New Guinea (Lake Sentani!, pond near Humboldt Bay!).

Fresh water.

Order LABYRINTHICI.

Physoclistic. Cylindrical and elongate or compressed and oblong. Mouth large or small. Intermaxillaries protractile, excluding the edentulous maxillaries from the oral border. The jaws with fixed, conical teeth; in one case (*Helostoma*) only movable ones on lips. Vomer and palatines with or without teeth. Teeth on parasphenoid present. Scales large or moderate, cycloid or ctenoid. Lateral line present and continuous, or interrupted, or vestigial, or absent. The single dorsal fin long, inserted above base of pectorals, longer than anal fin, or shorter than it and beginning behind base of pectorals. Dorsal and anal with or without spines, the rays branched or not. Pectorals situated below middle of height. Ventrals thoracic, subabdominal or absent, composed of six rays, the outer of which is unbranched or spine-like; the rays may be reduced to one. Pelvic bones remote from cleithra or attached to them. Parietal bones are separated by the supraoccipital, an orbitosphenoid wanting. Four gills. Pseudobranchiae none or rudimentary. A suprabranchial organ constituted by a system of labyrinthic lamellar processes from the outside of the epibranchial of the first branchial arch, enclosed in an accessory cavity, separate from the pharyngeal cavity, but in communication with the branchial cavity, by an opening above the two anterior gillslits. In *Ophiocephalidae* the suprabranchial cavity is more like a diverticulum of the pharyngeal cavity, as it is in open communication with it. It is also without a labyrinthiform organ but covered by a mucous membran fit for accessory respiration.

Synopsis of the suborders of Labyrinthici.

1. Dorsal and anal with articulated rays only. Ventrals, when present, with six rays. Scales cycloid. Suprabranchial cavity without labyrinthiform organ. . . . . *Ophiocephaloidei* p. 313.
2. Dorsal and anal with one or more spines. Ventrals with five or less rays and a spine, or reduced to a single ray. Scales ctenoid. Suprabranchial cavity with a labyrinthiform organ . . . . . *Anabantoidei* p. 330.

1. Suborder Ophiocephaloidei.

Elongate, more or less cylindrical, compressed posteriorly. Fins without spines. Dorsal and anal fins long. Pectorals present. Ventrals present or absent, inserted not far behind pectorals. Pelvic bones connected to the symphysis of the cleithra by a ligament. Mouth large, protractile; the maxillaries excluded from the oral border. Curved teeth on intermaxillaries, mandibles, vomer and palatines. Canine teeth always present in lower jaw, sometimes also on vomer and palatines. Scales moderate, cycloid, striated, very large and shield-like on upper surface of head. Lateral line present, with a more or less developed curve in its anterior half or interrupted. Air-bladder present, continued into a prolongation of the abdominal cavity in the tail. Anterior ribs sessile, the remainder inserted on parapophyses. Four gills, gillrakers present. No pseudobranchiae. An accessory superbranchial cavity present, but no labyrinthiform organ [1]). Gillmembranes free from isthmus, but connected with each other.

Distribution: Freshwater of eastern and south-eastern Asia, indo-australian Archipelago as far as Halmahera to the east, and tropical Africa.

1. Ophiocephalus Bloch.

(Bloch, Ausländ. Fische VII. 1793, p. 137).

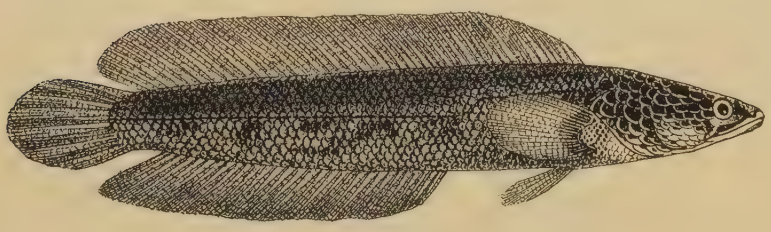


Fig. 84. *Ophiocephalus melanopterus* Blkr. × $^2/_9$.

Ventrals present. For other characters and for distribution of the genus, see those of the suborder.

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1) For particulars see Max Rauther, Ergebnisse und Fortschritte der Zoologie II. Heft 4, 1910, p. 522—531.

Key to the indo-australian species of Ophiocephalus.

A. On vomer and palatines a pluriserial band of small teeth, without large canines.

I. 3—3 1/2 scales in L.tr. between anterior rays of dorsal and lateral line. D. 44—47; A. 28—31.

a. Head 3.1. A black white-edged ocellus at the upper part of the base of the caudal. *O. marulioides* p. 315.

b. Head 3.5—3.8. No ocellus at base of caudal. A series of irregular dark patches along the sides . . . . . *O. melanopterus* p. 315.

II. 4—5 scales in L.tr. between anterior rays of dorsal and lateral line. D. 37—43. A. 21—27.

a. L.l. 52—57. Pectorals shorter than postorbital part of head . . . . . *O. striatus* p. 317.

b. L.l. 50—52. Pectorals about as long as postorbital part of head. . . . . *O. melanosoma* p. 319.

B. On vomer and palatines one or two series of teeth, which are for the greater part canines or caninoid.

I. 3—3 1/2 scales in L.tr. between anterior rays of dorsal and lateral line. L.l. 41—43. D. 31—35. A. 21—24 . . . . . *O. gachua* p. 321.

II. 4 1/2—5 1/2 scales in L.tr. between anterior rays of dorsal and lateral line. L.l. 54—65. D. 36—43. A. 26—31.

a. 4 1/2 scales in L.tr. between anterior rays of dorsal and lateral line.

α. L.l. 55—58. Two black longitudinal narrow bands along head and body. . *O. bistriatus* p. 322.

β. L.l. 64. Uniform, young specimens with a lateral band, consisting of separate dark patches . . . . . *O. bankanensis* p. 323.

b. 5 1/2 scales in L.tr. between anterior rays of dorsal and lateral line.

α. Upper profile of head straight. L.l. 57—58. Sides with 4—5 black ocelli, surrounded by yellowish rings . . . . . *O. pleurophthalmus* p. 324.

β. Upper profile of head more or less concave, except in young specimens. L.l. 58—65. Spots on sides sometimes present, but never forming ocelli. . . . . *O. lucius* p. 326.

III. $5^1/_2-6^1/_2$ scales in L.tr. between anterior rays of dorsal and lateral line. L.l. 82—91.
D. 42—47. A. 25—28 . . . . . *O. micropeltes* p. 328.
Doubtful species . . . . . *O. punctatus* p. 330.

1. Ophiocephalus marulioides Blkr.

Ophiocephalus marulioides Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 424. — Atl. ichth. IX. 1877, Tab. 399, fig. 2. — Verh. Akad. Amsterdam XIX. 1879, Poissons pharyng. labyrinth. p. 40.

D. 46—47; A. 30—31; P. 18; V. 6; L.l. 55—58; L.tr. $\frac{3\frac{1}{2}}{1}$.
$\overline{10}$

Cylindrical, compressed posteriorly. Height 6, 7.2 in length with caudal. Head 3.1, 3.7 in length with caudal. Head depressed, flat above, the profile sloping in a straight line from nape to snout. Eye 6.5, 1.6 in interorbital space and about equal to snout. Cleft of mouth somewhat oblique. Maxillary reaching to behind eye. Jaws equal. A pluriserial band of small equal teeth in the upper jaw. A Λ-shaped band of teeth on anterior part of vomer, subcontinuous with the broader bands on the palatines. A pluriserial band of small teeth near the symphysis in the lower jaw, laterally tapering to one row of small teeth, with which distant blunt caninoids are intermingled. 5 rows of scales between eye and praeoperculum, 3 or 4 on operculum. Lateral line with an abrupt curve downwards at the 18th perforated scale. Dorsal beginning scarcely behind origin of pectorals, and ending somewhat behind end of anal; its origin separated by about 13 scales from snout. Origin of anal below 16th dorsal ray. Pectorals about equal to postorbital part of head. Ventrals originating behind origin of dorsal, equal to head without snout. Dark brown, somewhat lighter below. Fins brownish blue, ventrals dusky. A black white-edged ocellus at the upper part of the base of the caudal. Length 270 mm.

Habitat: Sumatra (Deli!, Djambi!); Banka; Biliton; Borneo (Sambas, Bankayan).

In rivers and ponds.

2. Ophiocephalus melanopterus Blkr. [Fig. 84, p. 313].

Ophiocephalus melanopterus Bleeker, Nat. Tijdschr. Ned. Indië IX. 1855, p. 420. — Atl. ichth. IX. 1877, Tab. 398, fig. 2. — Verh. Akad. Amsterdam XIX. 1879, Poissons pharyng. labyrinth. p. 41.

Ophiocephalus marulius Boulenger, Proc. Zool. Soc. London 1890. p. 38 (nec H.B.).
Ophiocephalus marulius Volz, Revue Suisse de Zool. XII. 1904, p. 460 (nec H.B.).

D. 44—47; A. 28—31; P. 17—18; V. 1.5; L.l. 54—57; L. tr. $\frac{3—3\frac{1}{2}}{1}$.
$\frac{}{10}$

Cylindrical anteriorly, compressed posteriorly. Height 5.9—6.3, 7—7.2 in length with caudal. Head 3.5—3.8, 4—4.6 in length with caudal. Head depressed, its upper profile sloping in a nearly straight line from occiput to snout. Eye 7—8.2, about 2.5 in interorbital space. Snout less than twice length of eye, its tip about in the horizontal through middle of eye. Cleft of mouth somewhat oblique. Maxillary reaching behind eye. Lower jaw somewhat prominent. Bands of small teeth in both jaws and on palatines and anterior part of vomer, those of palatines and that of vomer subcontinuous. No enlarged teeth except a row of distant, strong but short canines in the lower jaw, behind the band of small teeth, which is only well developed near the symphysis and consists of only two rows or even one row laterally. About 5 rows of scales between eye and hindborder of praeoperculum, 3 or 4 on operculum. Lateral line with an abrupt curve downwards at about the 16th perforated scale. Dorsal beginning behind base of pectorals and ending somewhat behind end of anal, its origin separated by 13—15 scales from snout. Origin of anal about below 16th dorsal ray. Pectorals about equal to postorbital part of head. Ventrals originating below origin of dorsal, more than half as long as pectorals. Dark brown or bluish above, lighter below; along the sides, just below the lateral line, there are groups of about 6 scales which are black, forming a longitudinal series of irregular dark patches. Dorsal, anal, pectorals and caudal blackish; dorsal and anal somewhat freckled with whitish. Ventrals more or less dusky, as also sometimes the pectorals. Length 650 mm.

Habitat: Sumatra (Palembang! Indragiri, Gunung Sahilan!, Djambi!, Deli?); Borneo (Pontianak) [1]).

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1) According to Bean & Weed (Proc. U.S. Nat. Mus. 42, 1912, p. 607), this species is also found on Java (Buitenzorg, Palabuan Ratu). We suppose that some mistake is made, as it is hardly believable that Bleeker and so many other ichthyologist after him, who collected at Buitenzorg, would have overlooked this species.

3. Ophiocephalus striatus Bl.

Ophiocephalus striatus Bloch, Ausl. Fische VII. 1793, p. 141, tab. 359.
Ophiocephalus wrahl Lacépède, Hist. Nat. Poissons III. 1802, p. 551.
Ophiocephalus wrahl Hamilton Buchanan, Fishes of the Ganges, 1822, p. 60.
Ophiocephalus chena Hamilton Buchanan, ibid. p. 62.
Ophicephalus striatus Cuvier & Valenciennes, Hist. Nat. Poissons VII. 1831, p. 417.
Ophicephalus planiceps Cuvier & Valenciennes, ibid. p. 425.
Ophicephalus sowarah Bleeker, Nat. & Geneesk. Arch. Ned. Indië II. (3) 1845, p. 519.
Ophicephalus planiceps Bleeker, l.c.
Ophicephalus striatus Bleeker, Verh. Bat. Gen. XXIII. 1850, Doolh. kieuw. p. 13.
Ophiocephalus striatus Cantor, Journ. Asiat. Soc. Bengal, XVIII. 1850, p. 1074.
? *Ophiocephalus cyanospilos* Bleeker, Nat. Tijdschr. Ned. Indië IV. 1853, p. 256.
Ophiocephalus striatus Günther, Cat. Brit. Mus. III. 1859—1861, p. 474.
Ophiocephalus striatus Kner, Novara-Exp. Fische 1865—1867, p. 234.
Ophiocephalus vagus Peters, Monatsber. Akad. Berlin (1868) 1869, p. 260.
Ophiocephalus striatus Bleeker, Atl. ichth. IX. 1877, tab. 399, Fig. 1. — Verh. Akad. Amsterdam XIX. 1879, Poissons pharyng. labyr. p. 42.
? *Ophiocephalus cyanospilus* Bleeker, Atl. ichth. IX. 1877, tab. 397, fig. 2. — l.c. p. 45.
Ophiocephalus striatus Vinciguerra, Ann. Mus. Civ. Genova (2) II. 1885, p. 89.
Ophiocephalus striatus Day, Fishes of India 4°. 1878—1888, p. 366.
Ophiocephalus striatus Vinciguerra, Ann. Mus. Civ. Genova (2) IX. 1890, p. 184.
Ophiocephalus striatus Steindachner, Ann. K. K. Naturh. Hofmus. XI. 1896, p. 227.
Ophioeephalus striatus Smith, Bull. U. S. Fish Comm. XXI. (1901) 1902, p. 171.
Ophicephalus striatus Jordan & Evermann, Bull. U. S. Fish. Comm. XXIII. (1903) 1905, p. 533.
Ophiocephalus striatus Jordan & Seale, Bull. Bur. Fish Wash. XXVI. (1906) 1907, p. 27.
Ophiocephalus striatus Sundara Raj, Rec. Indian Mus. XII. 1916, p. 270.

D. 38—43; A. 23—27; P. 15—17; V. 6; L. l. 52—57; L. tr. $\frac{4\ (4\frac{1}{2})—5}{1}$.
$\frac{}{8—10}$

Cylindrical anteriorly, compressed posteriorly. Height 5—6, 6—7.3 in length with caudal. Head 3—3.2, 3.6 in length with caudal. Head depressed, its upper profile somewhat convex, interorbital space flat. Eye 5 (in specimen of 80 mm.)—8 (in specimen of 340 mm.), twice (or less in small specimens) in interorbital space. Snout less than twice length of eye, its tip in the horizontal through middle of eye. Cleft of mouth oblique. Maxillary reaching behind eye, in young specimens not so far. Lower jaw slightly prominent. In the intermaxillaries bands of about 5 or 6 rows of teeth anteriorly, tapering posteriorly. These teeth are pointed and curved backwards, the postsymphysial ones longer and canine-like. In the mandibles the teeth are placed in several rows near the symphysis, in one row laterally.

They are about equal to those in the intermaxillaries. In the lateral row there are on each side about 5 equidistant canines. Teeth on vomer and palatines slender, curved backwards, in several rows, those of the posterior row the longer. On the vomer they form a Λ-shaped patch; on the palatines an elongate band. There are 6 or 7 rows of scales between the eye and the hindborder of the praeoperculum and 4 rows on the operculum. Lateral line with an abrupt curve downwards at about the 17th—20th perforated scale. Dorsal beginning behind base of pectorals and ending somewhat behind end of anal. Its origin separated by about 15 scales from tip of snout. Origin of anal about below 17th dorsal ray. Pectorals shorter than postorbital part of head. Ventrals originating about below origin of dorsal, equal to distance between hindborder of eye and hindborder of praeoperculum. Greenish or brownish above to almost black, white or silvery or light brown below. Upper parts with dark streaks and blotches, more or less arranged in oblique bars running forwards, lower parts with similar blotches and streaks, at right angles with those of the upper parts. In older specimens the upper parts are generally so dark as to make these markings obsolete. Lower surface of head and belly white, more or less freckled with brown. A dark band running from corner of mouth to suboperculum, sometimes very faint or absent in old specimens. Pectorals brownish to dark brown. Ventrals white, generally freckled with brown. Dorsal and anal generally freckled or streaked with brown and white. In young individuals there is sometimes a black ocellus at the end of the dorsal fin. Caudal brownish, with obsolete dark bands. Length over 900 mm.

Nom. indig.: Gabus (Malay. Javan.), Rajong (Sundan.), Deluk, Kuto (Javan. Madura), Badō (Gaju), Batje (Atjeh), Se Punkat (Palembang), Haruan (Banjermassin).

Habitat: Rivers, lakes and ponds of Sumatra!, Pulu Weh!, Singapore, Banka, Singkep!, Borneo!, Java!, Madura, Celebes!, Bali, Lombok!, Flores!, Ambon!, Batjan, Halmahera. — Philippines, Pinang, Malay Peninsula, Siam, China, British India and Ceylon. Introduced in the Hawaiian Islands.

Note: Numerous specimens of this very common food fish seen by us. According to SUNDARA RAJ (l.c. p. 271): "the nest consists of a circular clearing in grassy swamps or in the weedy edges of ponds and rivers. Both parents, the male in

particular, keep guard. The eggs, which are large (1.25 mm.) and float at the surface, are never numerous but vary from a few hundreds to a few thousands according to the size of the fish. Dr. A. WILLEY gives a full description of the nest, egg and young of this species in Spolia Zeylanica, vol. VI, pp. 108—123."

Ophiocephalus cyanospilus is known from the type specimen only, when we except 2 specimens mentioned by VOLZ (Revue Suisse de Zoologie XII. 1904, p. 460) with a ? behind that name. This type specimen is a young fish of 102 mm. and differs according to BLEEKER, from *O. striatus* by the presence of small bluish or mother-of-pearl coloured ocelli on the ventral side of the trunk. The origin of the dorsal is situated "circiter" above that of the pectorals and the maxillary reaches only to below hindborder of eye. Lastnamed character is due to the young age of the specimen, the other differences from *O. striatus* are so slight, that it seems to us justified to range *O. cyanospilus* — although with a? — under the synonyms of *O. striatus*.

The type of *O. cyanospilus*, which came from Telokbetong, Sumatra, is apparently lost, as it is neither in the Leiden nor in the British Museum.

4. Ophiocephalus melanosoma Blkr.

Ophicephalus melasoma Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 424.
Ophicephalus rhodotaenia Bleeker, ibid. p. 425.
Ophicephalus mystax Bleeker, Nat. Tijdschr. Ned. Ind. V. 1853, p. 188.
Ophiocephalus melanosoma Günther, Cat. Brit. Mus. III. 1861, p. 473.
Ophiocephalus melanosoma Bleeker, Atl. ichth. IX. 1877, Tab. 399. fig. 4. — Verh. Akad. Amsterdam XIX. 1879, Poissons pharyng. labyr. p. 46.
Ophiocephalus rhodotaenia Bleeker, ibid. p. 47.
Ophiocephalus baramensis Steindachner, Abh. Senckenb. Naturf. Gesellsch. XXV. 1901, p. 435.
Ophiocephalus rhodotaenia Steindachner, l.c.
Ophiocephalus mystax Volz, Revue Suisse de Zoologie XII. fasc. 2, 1904, p. 459.
Ophiocephalus melanosoma Volz, ibid. p. 460.

D. 37—41; A. 21—25; P. 14—15; V. 6; L.l. 50—52; L.tr. $\frac{4—4\frac{1}{2}}{1}$. $\frac{}{8—9}$

Cylindrical anteriorly, compressed posteriorly. Height 5—5.8, 5.9—7.2 in length with caudal. Head 3.1—3.3, 3.8—4.2 in length with caudal. Head depressed, its upper profile straight, interorbital space flat. Eye 5.7 (in specimen of 168 mm.) — 7 (in spec. of 285 mm.), about twice or a little less, in small

specimens, in interorbital space. Snout less than twice diameter of eye, its tip in the horizontal through lower half of eye. Cleft of mouth rather oblique. Maxillary reaching far behind eye or to hindborder of eye in small specimens. Lower jaw slightly prominent. A rather broad villiform band of teeth in the intermaxillaries, teeth coarser in the symphysial part, especially the hindermost. In the lower jaw several rows of teeth near the symphysis, laterally only one row, behind which equidistant strong canines. A Λ-formed patch of moderate strong teeth on vomer and an elongate band of strong teeth on the palatines, the innermost row the largest and caninoid. All the teeth curved backwards. There are 5 or 6 scales in a row between the eye and the hindborder of the praeoperculum and 3—4 rows on the operculum. Lateral line with an abrupt curve downwards of 3 scales at about the 14th or 15th perforated scale. Dorsal beginning behind base of pectorals and ending somewhat behind end of anal. Its origin separated by 15—16 scales from tip of snout. Origin of anal below 14th dorsal ray. Pectorals about as long as postorbital part of head. Ventrals originating about below origin of dorsal, about equal to distance between hindborder of eye and hindborder of praeoperculum. Colour of alcohol specimens dark greenish or bluish above, yellowish or reddish brown below. A rather inconspicuous dark oblique stripe behind corner of mouth. Underparts of head sometimes with yellow spots. Pectorals and dorsal and caudal dark, ventrals of the colour of the lower parts, sometimes striped in their hinderpart. Anal light, with a subterminal dark band. In young specimens (always?) a red lateral band from snout to caudal. Length 285 mm. [Type of *O. baramensis* Steind. in the Vienna Museum seen by us].

Habitat: Sumatra (Palembang, Lahat, Gunung Sahilan!, Ringgat!, Laut Tador, Lower Langkat); Banka; Borneo (Marawang, Toboali, uppercourse of river Kapuas, Sadong, Gambas, Sarawak, Baram river!). — Palawan Archipelago, Tonkin, Siam.

Note. *Ophiocephalus rhodotaenia* is based on a single specimen of 59 mm. long. A second one, still smaller (41 mm.) has been recorded by STEINDACHNER. The differences from *O. melanosoma* (the presence of a lateral red band and the maxillaries reaching only below hinderpart of eye) are referable to the young age of the specimens. We unite *O. rhodotaenia* therefore with *O. melanosoma*.

5. Ophiocephalus gachua H.B.

Ophiocephalus gachua Hamilton Buchanan, Fishes of the Ganges, 1822, p. 68.
Ophiocephalus aurantiacus Hamilton Buchanan, ibid. p. 69.
Ophicephalus marginatus Cuvier & Valenciennes, Hist. nat. Poissons, VII. 1831, p. 411.
Ophicephalus limbatus Cuvier & Valenciennes, ibid. tab. 201.
Ophicephalus cora-mota Cuvier & Valenciennes, ibid. p. 414.
Ophicephalus fuscus Cuvier & Valenciennes, l.c.
Ophicephalus aurantiacus Cuvier & Valenciennes, ibid. p. 415.
Ophiocephalus montanus McClelland, Calc. Journ. Nat. Hist. II. 1842, p. 583.
Philypnoides surakartensis Bleeker, Verh. Bat. Gen. XXII. (1848) 1849, Blenn. Gob. p. 19.
Ophicephalus marginatus Bleeker, Verh. Bat. Gen. XXIII. (1849) 1850, Doolh. kieuw. p. 14.
Ophiocephalus gachua Günther, Cat. Brit. Mus. III. 1859—1861, p. 471.
Ophiocephalus kelaarti Günther, ibid. p. 472.
Ophiocephalus gachua Kner, Fische Novara-Exp. 1865—1867, p. 233.
Ophiocephalus guachua var. *malaccensis* Peters, Monatsber. Akad. Wiss. Berlin, 1868, p. 262.
Ophiocephalus gachua Bleeker, Atl. ichth. IX. 1877, tab. 397, fig. 4. — Verh. Akad. Amsterdam, XIX. 1879, Poissons pharyng. labyr. p. 38.
Ophiocephalus gachua Day, Fishes of India 4°. 1878—1888, p. 367.
Ophiocephalus gachua Vinciguerra, Annal. Museo Civico Genova (2) IX. 1890, p. 185.
Ophiocephalus gachua Bean & Weed, Proc. U. S. Nat. Mus. XLII. 1912, p. 608.
Ophiocephalus gachua Sundara Raj, Record Ind. Mus. XII. Prt. VI. 1916, p. 275.

D. 31—35; A. 21—24; P. 13—16; V. 6; L.l. 41—43; L.tr. $\frac{3\ (3\frac{1}{2})}{1}$ / 7.

Body somewhat cylindrical anteriorly, compressed posteriorly. Height 5.5—6.5, 6.7—8.3 in length with caudal. Head 3.1—3.5, 4—4.3 in length with caudal. Head depressed, flat above, its upper profile sloping down in a nearly straight line or somewhat convex. Eye 5 (in specimen of 65 mm.) —8 (in specimen of 142 mm.), in large specimens more than twice, in small specimens less than twice in the interorbital space, about 1—1.5 in snout. Tip of snout in the horizontal through middle or upper part of eye. Cleft of mouth oblique. Maxillary reaching to vertical through hindborder of eye, in small specimens not so far. Lower jaw somewhat prominent. A band of small teeth in the intermaxillaries. Teeth on the palatines and on the foremost part of the vomer forming a continuous biserial curved band, the outer teeth smaller, the inner teeth canines or caninoid. A band of small teeth, tapering laterally, in the lower jaw, the most interior row consisting of caninoid or canine teeth. About 5 rows of scales between eye and poste-

rior border of praeoperculum and about 3 rows on operculum. Lateral line curving one scale downward behind the 11th—13th perforated scale. Dorsal beginning behind origin of pectorals and ending somewhat behind anal, its origin separated by 13—14 scales from tip of snout. Origin of anal about below 9th—11th dorsal ray. Pectorals somewhat more or less than postorbital part of head. Ventrals originating somewhat before origin of dorsal, about half as long as pectorals. Colour brownish, darker above, lighter below, with traces of darker crossbars, more conspicuous in young specimens and often quite obsolete in adult ones. In young specimens there are often some black spots scattered over the body. Dorsal, anal and caudal with a white margin, the rest of the fins uniformly dark bluish black or lighter, striped with black. Ventrals hyaline, with a dusky streak. Pectorals black at the base, the black area bordered behind by a white band. Generally this band is followed by other ones distally, the bands being about their breadth apart and giving to the fin a striped appearance. Length over 300 mm.

Nom. indig.: Gabus (Malay Batavia), Boga, Heedjo gaddo (Sund.), Kuto and Kuto bengo (Javan.).

Habitat: Common in rivers, lakes and ponds and entering brackish water of: Singapore, Nias!, Sumatra!, Banka, Biliton, Borneo!, Java!, Bawean, Madura. — Malay Peninsula, Siam, Andamans, Ceylon, British India, Balutchistan and Afghanistan.

6. **Ophiocephalus bistriatus** nom. nov.

Ophiocephalus bivittatus J. Károli, Termesz. Füzetek V. 1882, p. 24 (nec Bleeker).

D. 36—41; A. 26—28; P. 16; V. 6; L.l. 55—58 [45—50 according to KÁROLI]; L. tr. $\frac{4\frac{1}{2}}{1}$ / $\frac{}{10—11}$.

Cylindrical, compressed posteriorly, 5.7—6.5, 7—8 in length with caudal. Head 2.8, 3.5 in length with caudal. Head depressed, above flat end covered with large scales. Eye 4.5—5, one diameter apart and somewhat longer than snout. Cleft of mouth oblique. Maxillary not reaching to the vertical through hindborder of eye. Lower jaw somewhat prominent. Small equal teeth in a pluriserial band in the upper jaw as also in the symphysial part of the lower jaw; the rami of the lower jaw with one or two series of small teeth and distant canines.

Palatines and anterior part of vomer with a subcontinuous series of small teeth and a row of distant canines. About eleven rows of scales between eye and praeoperculum and 4 or 5 rows of scales on operculum. Lateral line with an abrupt curve downwards at about the 18th scale. Dorsal beginning scarcely behind pectorals, ending behind end of anal, its origin separated by about 17 scales from snout. Pectorals shorter than postorbital part of head, ventrals not much shorter than pectorals. Light brownish above, lighter below. Two black longitudinal narrow bands, one above and one below the lateral line, the upper one beginning behind eye, running along upper margin of operculum, the lower one beginning at snout, running through eye and through base of pectorals, both bands continued on the caudal fin. Length 60 mm.

Habitat: Borneo (Balikpapan!, Sarawak).

In rivers.

Note. The 6 specimens of KÁROLI, measuring from 50—60 mm. and our 3 specimens from Sungei Manggar, Balikpapan, which are about of the same length, are the only ones known of this species. It is possible that they represent the young age of *O. lucius*, with which they seem to be most related.

7. Ophiocephalus bankanensis Blkr.

Ophiocephalus bankanensis Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 726. — ibid. V. 1853, p. 187. — Atl. ichth. IX. 1877, Tab. 397, fig. 1. — Verh. Akad. Amsterdam, XIX. 1879, Poissons pharyng. labyr. p. 51.

D. 39—42; A. 29—31; P. 15—16; V. 1.5; L.l. 64; L.tr. $\frac{4\frac{1}{2}}{1}$ $\frac{}{8—9}$.

Compressed. Height 6, 7 in length with caudal. Head 3.4, 4 in length with caudal. Head not depressed, rounded above, its upper profile somewhat convex. Eye 5.5—7.5, 1.5—2 in somewhat convex interorbital space. Snout as long as or slightly longer than eye, its tip in the horizontal through upper half of eye. Cleft of mouth very oblique. Maxillaries reaching to vertical through hindborder of eye, not so far in small specimens. Lower jaw somewhat prominent. A comparatively narrow band of villiform teeth in the intermaxillaries. A band of a few rows of similar teeth in the lower jaw, with a row of equidistant canines behind it. On vomer and palatines a single or double row of strong canines of unequal size. There are 8 or 9 scales in a row between hindborder of eye and that of praeoper-

culum and about 5 rows of scales on the operculum. Lateral line with a gentle curve downwards at about the 19th perforated scale. Dorsal beginning scarcely behind origin of pectorals and ending above end of anal. Its origin separated by 16—17 scales from tip of snout. Origin of anal below 12th dorsal ray. Pectorals much shorter than postorbital part of head, about twice in head. Ventrals originating behind origin of dorsal, less than distance between hindborder of eye and hindborder of praeoperculum. Colour of alcohol specimens of BLEEKER's collection brown, somewhat lighter below. Fins brown, more or less variegated with darker. In younger specimens there are three dark oblique streaks behind eye and a dark patch on operculum. A lateral band, consisting of separate dark patches, bordered by yellowish. Pectorals with some light spots. Length 235 mm. [Specimens of BLEEKER's collection in the Amsterdam and British Museum seen by us].

Habitat: Banka, Borneo (Banjermasin, mouth and middle course of river Kapuas, Danau Sriang).

In rivers and ponds.

8. **Ophiocephalus pleurophthalmus** Blkr.

Ophicephalus pleurophthalmus Bleeker, Nat. Tijdschr. Ned. Indië I. 1850, p. 270. — Act. Soc. Scient. Indo-Neerl. III. 1858, Zesde Bijdr. Sumatra, p. 37.
Ophicephalus urophthalmus Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 578.
Ophiocephalus pleurophthalmus Günther, Cat. Brit. Mus. III. 1859—1861, p. 479.
Ophiocephalus pleurophthalmus Bleeker, Atl. ichth. IX. 1877, Tab. 397, fig. 3. — Verh. Akad. Amsterdam, XIX. 1879, Poissons pharyng. labyr. p. 48.
? *Ophicephalus spiritalis* Fowler, Journ. Acad. Nat. Sc. Philadelphia (2) XII, 1904, p. 530.

D. 40—43; A. 28—31; P. 17—18; V. 6; L.l. 57—58; L.tr. $\frac{5\frac{1}{2}}{11}$.

Body cylindrical, somewhat compressed, more so posteriorly. Height 4.5 to nearly 5, 5.5 to nearly 6 in length with caudal. Head 2.8—3, 3.5—3.8 in length with caudal. Head compressed, rather pointed, its upper profile straight, interorbital space flat. Eye 5.5 to nearly 7, less than 1.5 to somewhat more than 1.5 in the interorbital space and 1.3—1.5 in snout. Tip of snout in the horizontal through middle of eye. Cleft of mouth somewhat oblique. Maxillaries reaching below hindborder of eye or not so far. Lower jaw prominent, much so in old specimens. A band of about 4 rows of small teeth in the intermaxillaries, those near the symphysis longer, especially in

the hindermost row. Few caninoid teeth in the frontpart of the vomer, in one row, forming a Λ. A row of small teeth on the palatines, with a series of distant canines, about 4 or 5 on each side. In the mandibles a band of about 4 rows of small teeth in front, tapering laterally and with a series of distant canines. About 10—12 rows of scales between eye and hindborder of praeoperculum, 5 or 6 rows of scales on operculum. Linea lateralis running in a straight line, without any abrupt curve or interruption. Dorsal beginning above origin of pectorals and ending scarcely behind anal, its origin separated by 17—20 scales from tip of snout. Origin of anal below 13th dorsal ray. Pectorals about one eye-diameter shorter than postorbital part of head. Ventrals originating behind origin of dorsal, somewhat shorter than pectorals. Brownish above, yellowish white below. Two dark parallel bands running from the hindborder of the eye somewhat obliquely downwards to the interoperculum. Four or 5 black ocelli, surrounded by a yellowish ring and larger than the eye: the first partly on praeoperculum, partly on operculum, the following three at some distance of each other on the lateral line, the second, which may be absent, above the anus, the third about below the middle of the dorsal and the fourth below the last third of dorsal; the fifth in the middle of the base of the caudal fin. Dorsal, anal and caudal with indistinct light and dark crossbars. Pectorals and ventrals more or less dusky, base of pectorals brown. Length almost 400 mm. [1]).

Habitat: Sumatra (Palembang!, Djambi!, Padang?); Borneo (Banjermassin, river Kapuas, Sebruang, Knapei, Matang, Danau Sriang, Pulu Matjan).

In rivers.

1) *O. spiritalis* Fowler, from Padang, is intermediate in many respects between *O. pleurophthalmus* and *O. lucius*. The number of scales in the L.l. (55), the fin formula (D. 29, A. 28) do not give any definite clue to which of the two species *O. spiritalis* belongs, although the low number of scales points to *O. pleurophthalmus*. According to the figure the profile of the head is somewhat concave, but not so much as in *O. lucius*. The blotches on opercle and body correspond fairly well with the ocelli of *O. pleurophthalmus*, but they miss the light rings of the latter. The bars on the pectorals are again exactly what we see in specimens of *O. lucius*. *O. spiritalis* may be a hybrid of the two species, although we are not aware that hybridisation is known in *Ophiocephalus*.

9. Ophiocephalus lucius (K. v. H.) C.V.

Ophicephalus lucius (K. v. H.) Cuvier & Valenciennes, Hist. Nat. Poissons VII. 1831, p. 416.
Ophicephalus lucius Bleeker, Verh. Bat. Gen. XXIII. 1850, Doolh. Kieuw. p. 13.
Ophiocephalus popylepis Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 578. — Atl. ichth. IX. 1877, Tab. 398, fig. 4. — Verh. Akad. Amsterdam XIX. 1879, Poissons pharyng. labyr. p. 50.
Ophiocephalus lucius Bleeker, Atlas ichth. IX. 1877, Tab. 398, fig. 1. — Verh. Akad. Amsterdam XIX. 1879, Poissons pharyng. labyr. p. 53.
Ophiocephalus polylepis M. Weber, Zool. Ergebn. Heft 2, 1894, p. 417.
Ophicephalus polylepis Vaillant, Notes Leyden Mus. XXIV. 1902, p. 32.
Ophiocephalus lucius Volz, Revue Suisse de Zool. XII. 1904, p. 460.
? *Ophiocephalus polylepis* Volz, l. c.
Ophiocephalus polylepis Popta, Notes Leyden Mus. XXVII. 1906, p. 5.

D. 38—41; A. 27—29; P. 16—18; V. 6; L.l. 58—65; L.tr. $\frac{5\frac{1}{2}}{1}$ $\frac{}{10-11}$.

Cylindrical, compressed posteriorly. Height $4^1/_3$—5, more than 5 to more than 6 in length with caudal. Head 3—$3^1/_2$, $3^1/_2$—4 in length with caudal. Head depressed, its upper profile sloping down in a more or less concave line, varying according to the individuals and less pronounced in small specimens. Eye $5^1/_2$ (in specimen of 85 mm.) —10 (in specimen of 360 mm.). Less than twice to nearly 3 in flat or slightly convex interorbital space, 1.3 to twice in snout. Tip of snout in the horizontal through upper part of eye. Cleft of mouth oblique, reaching to vertical through hindborder of eye or not so far. Lower jaw prominent. A band of small teeth in the intermaxillaries. On vomer and palatines a single row of canines, between which smaller teeth are inserted. A band of small teeth in the mandibles, tapering posteriorly and having an inner series of distant canines. 10—13 rows of scales between eye and praeoperculum and 4—6 rows on operculum. Lateral line curving downwards 2 rows of scales at about the 18th—20th scale. Dorsal beginning above pectorals and ending above end of anal, its origin separated by 18—19 scales from tip of snout. Origin of anal below 11th or 12th dorsal ray. Pectorals equal to distance between eye and hindborder of praeoperculum or longer, but considerably shorter than postorbital part of head. Ventrals not much shorter than pectorals, originating behind origin of dorsal. Colour variable. In young specimens brownish above, yellowish below, with a black lateral interrupted band running from the hindborder of the eye to base of caudal and forming

a series of large spots along the side of the body. In the interspaces between those spots there is more dorsally a similar row of less dark spots, these two alternating rows of spots covering almost the whole sides of the body and leaving a light zic-zac lateral line between them. The centre of each spot of the upper row is formed by a darker oblique streak, which is at right angles with similar streaks on the ventral half of the body. In older specimens the whole fish is much darker and the markings on the body are more or less obsolete, the oblique streaks on the belly, which is lighter, remaining more conspicuous, but often completely vanishing in old specimens. Sometimes there are round black spots, irregularly arranged, on upper part of head and body. Dorsal, anal and caudal spotted or streaked with rows of blackish or whitish spots. Similar spots are often conspicuous on the ventral side of the head. Pectorals white, barred with brown; ventrals freckled or indistinctly barred with brown. Length 360 mm.

Nom. indig.: Gabus tjina (Malay Batavia), Mudju mudju (Korintji, Sumatra).

Habitat: Sumatra (Padang, Lake Singkarah!, Solok, Palembang!, Lahat, Taluk!, Muara Kompeh, Lower Langkat, Laut Tador, Lake Korintji!, Indragiri, Djapura, Djambi!, Deli); Banka; Biliton; Singkep!; Java (Batavia, Bekassi!, Buitenzorg!, Tjibiliong, Lelles, Semarang, Megamendok); Madura; Borneo (river Kajan!, river Mahakkam and its affluents Howong!, Bluu!, Bo!; Prabukarto, Banjermassin, river Kahajan, river Kapuas: Pontianak, Sebruang, Knapei, Putus Genting and river Raun!; Mandhor, Montrado, Sambas, river Baram, river Serawak). — Siam, China.

In rivers, lakes and ponds.

Note. *Ophiocephalus polylepis* Blkr. is based on a single young specimen of 114 mm., now preserved in the Leiden Museum and in such a bad state, that it is impossible to describe it properly. According to BLEEKER's description, the only difference of importance between *O. polylepis* and *lucius* would be that lastnamed species has one row of scales more above the lateral line than *O. polylepis*. In his diagnosis however BLEEKER states of the scales in the l.tr. "quarum 4 vel 5? supra lineam lateralem." All the specimens afterwards labelled by different authors as *O. polylepis* and which we examined, turned out to be *O. lucius*. We have not seen the specimens

of *O. polylepis* mentioned by VOLZ (Revue Suisse Zool. XII. 1904, p. 460) which is a pity, as VOLZ records *O. lucius* on the same page, from the same locality. Probably the last ones are large specimens, with concave profile, which differ considerably in aspect from the young ones, which he therefore referred to *O. polylepis*.

10. **Ophiocephalus micropeltes** (K. v. H.) C.V. [Fig. 85, p. 329].

Ophiocephalus micropeltes (Kuhl & van Hasselt) Cuvier & Valenciennes, Hist. nat. Poissons VII. 1831, p. 427.
Ophiocephalus serpentinus Cuvier & Valenciennes, Hist. Nat. Poiss. VII. 1831, p. 429.
Ophicephalus bivittatus Bleeker, Nat. Geneesk. Arch. Ned. Indië (II) 3, 1845, p. 519.
Ophicephalus micropeltes Bleeker, Verh. Bat. Gen. XXIII. 1850, Doolh. kieuw. p. 12.
Ophicephalus Stevensii Bleeker, Nat. Tijdschr. Ned. Indië V. 1853, p. 444.
Ophiocephalus micropeltes Günther, Cat. Brit. Mus. III. 1859—1861, p. 482.
Ophiocephalus diplogramme Day, Proc. Zool. Soc. London 1865, p. 36. — Fishes of Malabar, 1865, p. 147.
Ophiocephalus micropeltes von Martens, Preuss. Exp. nach Ostasien, Zool. Theil I. 1876, p. 303, Tab. 7, fig. 1.
Ophiocephalus micropeltes Bleeker, Atl. ichth. IX. 1877, Tab. 399, fig. 3. — Verh. Akad. Amsterdam XIX. 1879, Poissons pharyng. labyr. p. 55.
Ophiocephalus micropeltes Sauvage, Nouv. Arch. du Mus. IV. (2) 1881, p. 167.
Ophiocephalus micropeltes Day, Fishes of India, 4°, 1878—1888, p. 365.
Ophiocephalus studeri Volz, Zool. Anz. XXVI. 1903, p. 535. — Zool. Jahrb. Abth. Syst. XIX. 1903, p. 376.
Ophiocephalus micropeltes Weber & de Beaufort, in Maasz "Durch Zentral-Sumatra" Bd. II. 1912, p. 17.

D. 42—47; A. 25—28; P. 18—20; V. 1.5; L. l. 82—91; L. tr. $\frac{5\frac{1}{2}—6\frac{1}{2}}{1}$. $\frac{}{15—16}$

Cylindrical, compressed posteriorly. Height 5.1—5.5, 6.1—6.7 in length with caudal. Head 2.6—2.8, 3.1—3.4 in length with caudal. Head depressed, rather pointed, flat above, the profile from occiput to snout sloping in a straight line. Eye $6^1/_2$—$7^1/_2$, twice to 2.5 in the interorbital space and about 4.5 in the postorbital part of the head. Snout longer than, but not twice as long as eye, its tip in the horizontal through middle of eye. Cleft of mouth oblique. Maxillary reaching to behind eye. Lower jaw somewhat prominent. In the upper jaw a pluriserial band of small teeth. On the palatines and the anterior part of the vomer a continuous row of small teeth and immediately behind this a row of distant strong canines. Small teeth in several rows near the symphysis in the lower jaw,

laterally in one or two rows. Immediately behind these a row of distant strong canines. There are 15—17 rows of scales between the eye and the hindborder of the praeoperculum and about 8 rows on the operculum. Lateral line without abrupt curve, but sloping down in a more or less regular way in the fore part of its course. Dorsal beginning above or even somewhat before base of pectorals and ending scarcely behind end of anal; its origin separated by about 28 scales from snout. None of those scales on the head very much larger than the others. Origin of anal below 16th—18th dorsal ray. Pectorals about 1.5 or somewhat more in postorbital part of head. Ventrals originating at some distance behind pectorals and only a little shorter than lastnamed fins. Dark brown or bluish above, whitish below; two black parallel longitudinal bands, the upper one running from point of snout through eye to

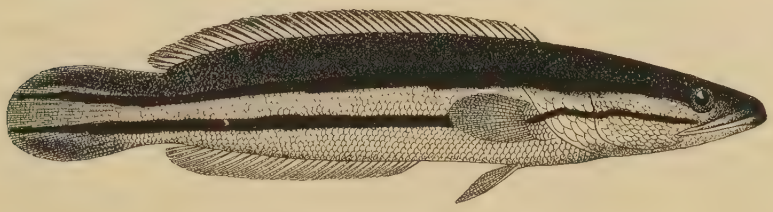

Fig. 85. *Ophiocephalus micropeltes* (K. v. H.) C.V. $\times \frac{1}{2}$.

end of caudal, the lower one beginning somewhat above corner of mouth, running through base of pectoral and also continued to end of caudal, the interspace between these bands brick-red in living specimens, but generally faded in preserved ones. In older specimens the black bands break up into irregular blotches and quite disappear in old specimens. Dorsal fin dusky or with irregular longitudinal bands in older specimens. Caudal dusky, with exception of the two dark bands and the red interspace in younger specimens. Pectorals, ventrals and anal whitish, the lastnamed fin with a black longitudinal band in old specimens. Length 640 mm.

Nom. indig.: Gabus Tobang (Malay), Ikan toman (lake Toba).

Habitat: Sumatra (Palembang!, Lahat, Muara Kompeh, Gunung Sahilan!, Djambi!, Laut Tador, Danau kota, Danau baru, Lake Toba!); Banka; Biliton; Java (Batavia, Tjibiliong, Lelles, Semarang); Madura; Borneo (Prabukarto, Banjermassin,

river Kapuas: Pontianak, Sintang, Knapei, Putus Genting!, Danau Sriang; Montrado, Sambas). — Siam, Indo-China, Malabar and Western coast of India.

In rivers and ponds.

Doubtful species.

Ophiocephalus punctatus Bl. a species from British India, but not known from Siam or Malakka, has been recorded by KNER from Java (Fische Novara Exp. I. 1865—1867, p. 233). BLEEKER (Verh. Akad. Amsterdam XIX 1879, Poissons pharyng. labyr. p. 36) supposes, that the locality "Java" is erroneous. We agree with BLEEKER, as KNER often made mistakes in the records of localities. KÁROLI (Termesz. Füzetek V. 1882, p. 25) records *O. punctatus* besides from Ceylon, from Borneo (Matang, Sarawak), Java (Palabuan, Sindanglaja) and under the name of *O. affinis* Gthr., which is according to DAY a synonym of *O. punctatus*, also from Singapore. Already the fact, that KÁROLI mentions this species from so many localities in the Indo-australian Archipelago, whereas it has never been recorded by other authors from there, makes it probable that KÁROLI made a mistake.

We don't think that *O. punctatus* ought to have a place on the list of Indo-australian species.

2. Suborder **Anabantoidei.**

Elongate and subcylindrical or usually compressed and oblong. Snout long with the cleft of mouth wide and horizontal, or snout short, mouthopening small, oblique; the lower jaw always prominent. Intermaxillaries more or less protractile. Teeth in jaws fixed, conical, never caniniform; in *Helostoma* movable, on lips only; palate, except *Anabas*, toothless. Scales large, generally regularly arranged; lateral line present, continuous or interrupted, or vestigial or absent. Dorsal long or short, in the last case shorter than anal, which is usually long. Both fins with or without spines, various in number and strength, the rays branched or not. Pectorals situated low down; ventrals thoracic, when complete with a spine and five soft rays, but often reduced till to one single filamentous ray. Gillopenings wide or narrow. Pseudobranchiae none. Suprabranchial cavity with a labyrinthiform organ (see p. 312).

Synopsis of the Anabantoidei.

1. Compressed, oblong. Snout short, mouthopening small, oblique. Intermaxillaries moderately protractile. Gill-openings narrowed by the broad union of the scaly gillmembranes. Dorsal and anal spines variable; anal long . . . . . *Anabantidae* 331.
2. Elongate, subcylindrical. Snout long, mouthopening rather wide, horizontal. Intermaxillaries strongly protractile. Gillopenings wide, the naked gillmembranes not being united. No dorsal and anal spines; anal deeply notched . . . . . *Luciocephalidae* p. 367.

1. Fam. Anabantidae.

More or less strongly compressed, oblong or elongate-oblong. Mouth usually small, oblique, the lower jaw prominent, bordered by intermaxillaries, which are usually protractile. Praeorbital entire or serrated. Jaws with bands of fixed conical teeth, except for *Helostoma*, where only movable teeth on the thick lips are present. Vomerine teeth in Asiatic genera only in *Anabas*, otherwise palate edentulous. The single dorsal is long, inserted above base of pectorals, longer than anal, or it is shorter or much shorter than anal, beginning behind base of pectorals. The dorsal is composed, according to its length, of I to XIX spines and 7 to 16 rays, which may be branched; the anal of I to XVII spines and 9 to 39 rays, branched or not [1]). Caudal rounded, cuneate, emarginate, in *Macropodus* forked. Pectorals rounded, situated below middle of height. Ventrals thoracic, with a spine and 5 soft rays. The first soft ray may be bifid or produced into a single long filament; or the ventral spine is rudimentary and adnate to it, the long filamentous first rays with two or three small branched rays in its axil or the ventrals are reduced to a single long filamentous ray. Scales moderate or large, ctenoid, usually regularly arranged; lateral line complete and continuous or interrupted below posterior part of dorsal, or it is incomplete, vestigial or absent. Opercular bones serrated or entire. Gill-openings narrow, the scaly gillmembranes being broadly united below isthmus. Pseudobranchiae none, or rudimentary. Four gills. Suprabranchial organ well developed.

1) By exception the dorsal and anal spines may be wanting or obsolete.

Key to the indo-australian Anabantidae.

I. Dorsal beginning above base of pectorals, longer than anal. Scales regularly arranged (*Dolichopteri* Canestrini).

A. Fixed conical teeth on vomer, palatines and jaws. Lateral line complete but interrupted. Ventrals with one spine and 5 soft rays, the first of which is bifid . . . . . *Anabas* p. 333.

B. No teeth on palate.

1. Ventrals with a spine and 5 soft rays, the first of which is bifid. Lateral line complete but interrupted.

a. Jaws with fixed conical teeth. Caudal rounded. *Polyacanthus* p. 337.

b. Moveable teeth on thickened lips; none in jaws. Caudal emarginate . . . . . *Helostoma* p. 339.

2. Each ventral reduced to a single long filamentous ray. Lateral line vestigial or absent. Caudal rounded . . . . . *Trichogaster* p. 340.

II. Dorsal beginning behind base of pectorals and shorter than anal. Jaws with fixed conical teeth. Palate toothless. First soft ray of ventrals produced into a single filament (*Brachypteri* Canestrini).

A. Ventrals with a spine and 5 soft rays. Scales regularly arranged.

1. L. l. complete and continuous. . . . . *Osphronemus* p. 342.

2. L.l. vestigial or absent.

a. Caudal forked. Anal XVI—XX 9—15. Dorsal and anal scaly at the base. . . . . *Macropodus* p. 344.

b. Caudal rounded or pointed. Anal with XIII or less spines.

α. Dorsal XIII 7, originating somewhat behind branchial opening. Dorsal and anal scaleless. Praeorbital entire . . . . . *Parosphromenus* p. 347.

β. Dorsal VIII—XII 7—10, its origin behind that of anal over spinous part of it. Anal scaly at the base. Praeorbital serrated. . *Sphaerichthys* p. 348.

γ. Dorsal II—VI 6—8, its origin over soft part of anal. Anal scaly at the base with IV—VIII spines. Praeorbital serrated . . *Ctenops* p. 350.

δ. Dorsal (I) 7—10, its origin over soft part of anal. Anal scaly at the base, with or without I—IV spines. Praeorbital entire. *Betta* p. 352.

B. Each ventral with a vestigial spine, adnate to a

long filamentous ray with two or 3 small rays in its axil. Scales irregularly arranged. L.l. complete but interrupted. Caudal emarginate . . . . . *Trichopodus* p. 364.

1. Anabas Cuvier.

(G. Cuvier, Règne anim. ed. Ia. 1817, p. 339).

Oblong, head rather broad, body posteriorly compressed. Mouth not protractile, its cleft extending at least to orbit, horizontal. Praeorbital serrated. Small, conical, fixed teeth in a band on jaws, also on vomer, none on palatines. Scales ciliate, large, regularly arranged. Lateral line a series of tubercles, interrupted below posterior part of spinous dorsal and continued lower down. Dorsal with 16—19 strong spines and 7—11 rays, commencing before origin of anal which has 9—11 spines and 8—12 rays. The soft dorsal and anal are shorter than the spinous part, the rays are branched, not prolonged

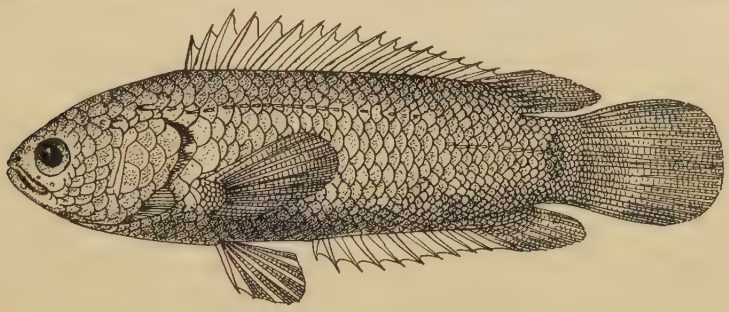

Fig. 86. *Anabas testudineus* (Bl.) × $^2/_3$.

and scaly at their base. Caudal rounded. Pectorals bluntly rounded. Ventrals inserted somewhat behind pectorals, with a spine and 5 branched rays, none of them prolonged. Operculum, sub- and interoperculum serrated. Branchial arches with toothed tubercles.

Distribution: Western and Central part of Indo-australian Archipelago as far as Batjan and Halmahera; Malay Peninsula, Philippines, South China, Siam, Tonkin, Burma, British India, Ceylon and when its near african relatives, known as *Spirobranchus* and *Ctenopoma* are united with *Anabas*, its habitat extends to the fresh water of Africa (Nile, Tschad Basin, Congo, South Africa).

In fresh and brackish water.

1. Anabas testudineus (Bl.) [Fig. 86, pag. 333].

Anthias testudineus Bloch, Ausländ. Fische VI. 1795, p. 121.
Perca scandens Daldorff, Transact. Linn. Soc. III. 1797, p. 62.
Amphiprion testudineus Bloch, Schneider, Syst. Ichthyol. 1801, p. 204.
Amphiprion scansor Bloch, Schneider, ibid. p. 570.
Lutjanus testudo Lacépède, Hist. Nat. Poissons IV. 1803, p. 235.
Lutjanus scandens Lacépède, ibid. p. 239.
Sparus testudineus Shaw, Zool. IV. 1803, p. 471.
Sparus scandens Shaw, ibid. p. 475.
Anabas testudineus Cuvier, Règne Animal, ed. Ia. II. 1817, p. 310.
Cojus cobojius Hamilton Buchanan, Fishes Ganges, 1822, p. 98 & 370.
Anabas scandens Cuvier & Valenciennes, Hist. Nat. Poissons VII. 1831, p. 249.
Anabas spinosus Gray, Ill. Ind. Zool. 11, 1834, pl. LXXXIX. fig. 1.
Anabas scandens Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1064.
Anabas scandens Bleeker, Verh. Bat. Gen. XXIII. 1850, Bijdr. Kennis Visschen met doolhofvormige kieuwen, p. 8.
Anabas variegatus Bleeker, Nat. Tijdschr. Ned. Indië II. 1851, p. 220 (after a drawing only).
Anabas macrocephalus Bleeker, ibid. VII. 1854, p. 430.
Anabas oligolepis Bleeker, ibid. VIII. 1855, p. 161.
Anabas scandens Bleeker, ibid. XIII. 1857, p. 329.
Anabas microcephalus Bleeker, Act. Soc. Sc. Indo-Neerl. II. 1857, Achtste Bijdr. vischfauna Amboina, p. 58.
Anabas scandens Günther, Cat. Brit. Mus. III. 1861, p. 375.
Anabas macrocephalus Günther, ibid. p. 376.
Anabas oligolepis Günther, l. c.
Anabas testudineus Peters, Monatsber. Akad. Wiss. Berlin, 1868, p. 259.
Anabas oligolepis Day, Proc. Zool. Soc. London 1869, p. 521.
Anabas oligolepis Bleeker, Atl. Ichth. IX. 1877, tab. 395, fig. 5. — Verh. Kon. Akad. Amsterdam XIX. 1879, Mém. Poissons pharyng. labyrinth. p. 5.
Anabas testudineus Bleeker, ibid. p. 7; Atl. ibid. tab. 396, fig. 2 & 3.
Anabas microcephalus Bleeker, ibid. p. 10; Atl. ibid. tab. 395, fig. 2.
Anabas scandens Day, Fishes of India 4°. 1878—1888, p. 370.
Anabas scandens Vinciguerra, Ann. Museo Civico Genova (2) IX. 1889—1890, p. 186.
Anabas scandens Reuvens, Notes Leyden Mus. XVI. N°. 3 and 4, 1895, p. 146.
Anabas elongatus Reuvens, ibid. p. 147.
Anabas scandens Steindachner, Abh. Senckenb. naturf. Gesellsch. XXV. 1901, p. 433.
Anabas scandens Smith, Bull. U. S. Fish Comm. XXI. (1901) 1902, p. 170.
Anabas scandens Jordan & Seale, Bull. Bur. Fish. Wash. (1906) 1907, p. 26.
Anabas scandens Tate Regan, Proc. Zool. Soc. London, 1909, p. 771.
Anabas scandens Sundara Raj, Rec. Ind. Mus. XII. Prt. VI. 1916. p. 276.
Anabas scandens van Oye, Contr. à la faune des Indes Néerl. I. fasc. III. 1917, p. 306, 307.

D. XVI—XIX. 7—10; A. IX—XI. 8—11; P. 14—16; V. I. 5; L. l. 26—31; L. tr. $\frac{3—4}{1}$ / $\frac{}{7—10}$.

Head subcylindrical, body and tail more or less compressed.

Dorsal profile arched, or only slightly convex. Ventral profile slightly convex. Height 2.3—3.2, 3—4.1 in length with caudal. Head 2.3—3.3, 3—4.2 in length with caudal. Eye 4—6, somewhat more than or equal to length of snout, 2.5—4 in postorbital part of head and 1.3—2.1 in convex interorbital space. Head scaly. Four to five rows of scales between eye and hindborder of praeoperculum. Operculum, subopercul um, interoperculum and praeorbital bordered by long radiating spines, less well defined, fewer in number in young and absent in very young specimens. Praeoperculum with some spines at its lower posterior border only. Posterior nostril close to frontborder of eye, larger than the anterior one, which is situated at some distance of the former and has a barbellike valve. Jaws equal, cleft of mouth oblique, reaching to below pupil. Rather narrow bands of small crowded teeth in jaws and one A-shaped row of somewhat larger teeth on vomer. None on palatines. Dorsal and anal spines strong, flattened anteroposteriorly. The first dorsal one, which is separated by 15—19 scales from snout, is the shortest, the 3rd—5th or the 4th—6th spines are the longest, about of the same size and longer than or equal to snout and eye together. Soft portion of dorsal and anal higher than the spinous part, rounded in the dorsal, obtusely pointed in the anal. First anal spine below 8th or 9th dorsal spine. Origin of pectorals below origin of dorsal. Pectorals as long as distance between middle of eye and hindborder of operculum or somewhat less. Ventrals originating somewhat behind origin of pectorals, their spine strong, about equal to interorbital space, longest soft rays shorter than postorbital part of head. Caudal rounded. Scales ctenoid, covered with numerous small tubercles. Lateral line interrupted below last dorsal scales and continued, two scales lower down, to caudal. Colour of alcohol specimens dark brown, lighter below or silvery below. Young and half grown specimens with transverse dark stripes on hinderpart of body and tail and a similar longitudinal stripe running from corner of mouth below eye. A large dark, white edged ocellus at base of caudal and a small one at hindborder of operculum. Sometimes instead of transverse stripes longitudinal ones, following the rows of scales, on hinderpart of body and tail. In fullgrown specimens the stripes disappear and the black blotches are often wanting. Fins brownish or dusky. Length 230 mm.

Nom. indig.: Betok, Bato, Harvan, Puju (Malay), Betik (Sundanese, Javanese), Pujo-Pujo (Bintang), Papuju hidju (Malay at Banjermassin), Geteh-geteh (Menado), Useng, Kusa or Kusang (Lake Matanna), Hoseng (Lake Towuti).

Habitat: Singapore; Sumatra (Telokbetong, Palembang!, Lahat, Muara Kompeh, Pajakombo, Padang, Priaman, Ulakan, Trussan, Gunung Sahilan!, Solok!, Fort de Kock!, Singkarah!, Lake Manindjau!, Upper Langkat, Djambi!, Taluk!, Ringat!, Deli); Nias!; Bintang; Banka; Java (Batavia!, Bantam, Anjer, Tandjong Oost, Tjampea, Buitenzorg!, Lake Dano, Serang, Tjiringin, Perdana, Tjibiliong, Pandeglang, Tjimanok, Cheribon, Lake Pandjallu, Garut!, Situ-Bagendit!, Gombong, Semarang, Ambarawa, Patjitan, Surakarta, Modjokerto, Surabaya, Ngawi, Kediri, Lake Grati, Pasuruan); Bawean Island; Borneo (Banjermassin, Prabukarta, Montrado, Pengaron, Kahajan, mouth river Kapuas, Sambas, Pontianak, Sarawak); Madura; Bali; Sumbawa; Sumba; Rotti!; Timor; Celebes (Makassar!, Maros!, Lake Sidenreng!, Teteadji!, Lake Posso!, Lake Matanna!, Lake Towuti!, Paré-Paré!, Kema, Pompanua, Tondano, Menado); Ambon; Batjan; Halmahera. — Ceylon, British India, Burma, Siam, Malakka, Tonkin, South China, Philippines.

In lakes, rivers, ponds, marshes and ditches and estuaries. Fresh and brackish water.

Note. Although we examined a great many specimens, we are still in doubt if they all belong to one species or that more species must be recognized. As the result of our study we can state, that among the specimens from the western part of the Archipelago there occur more individuals with seventeen dorsal spines and less than 28 scales in the lateral line than amongst those of the eastern part. We did not find any specimens from the indo-australian Archipelago with sixteen dorsal spines. BLEEKER however records sixteen spines in *A. oligolepis* from Borneo. In three specimens from British India (Calcutta and Orissa) we find XVI, XVI, XVII, but according to DAY l.c. the number of spines is XVII—XVIII, so it may be that our three specimens from British India have incidentally less spines. DAY seems never to have met specimens with nineteen spines, but these are rather frequent in the indo-australian Archipelago, especially in material from Celebes and Rotti.

Resuming we may say, that the relative number of speci-

mens with more dorsal spines and more scales in the L. l. increases from West to East.

Since the times of DALDORFF (1797) this fish, living in ponds and ditches, is renowned as the "Climbing Perch", according to its supposed ability to ascend trees, the highly mobile suboperculum with its strong spines being the chief organ of climbing. This may happen accidentally, as the fish is able to leave the water and migrate long distance on land in search of other ponds, offering better biological conditions.

The progress on land by erecting its fins, scales and opercles lying flat on one side or by keeping its erect position, is described by DAY (Fishes of Malabar, p. 133). The extraordinary air-breathing power by retaining water in the superbranchial organ, to keep its thin laminae wet, and its great tenacity of life enable *Anabas* to live even for six days out of the water or to be buried in exsiccated mud and to bear transport well, even when exposed for some time to the sun.

Its development is recorded by B. SUNDARA RAJ (Records Indian Mus. XII. 1916, p. 276).

2. **Polyacanthus** (K. v. H.) Cuvier & Valenciennes.

(CUVIER & VALENCIENNES, Hist. Nat. Poissons VII. 1831, p. 353 [p. p.]).
Polyacanthus Günther, Cat. Brit. Mus. III. 1859—1861, p. 378 (p. p.).
Polyacanthus Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 12.

Strongly compressed, oblong. Mouth slightly protractile, its

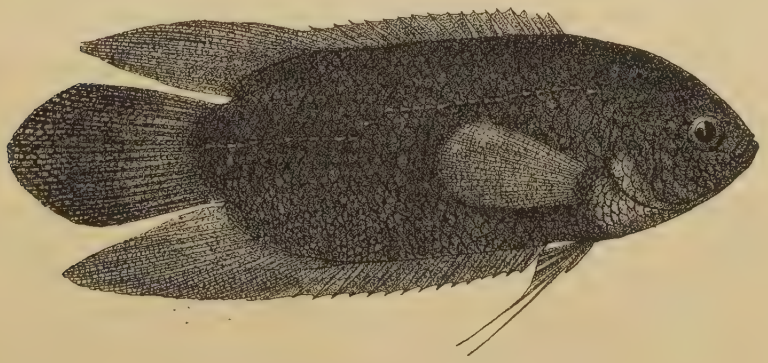

Fig. 87. *Polyacanthus hasselti* C.V. × 5/8.

cleft rather small, oblique, not extending beyond vertical through frontmargin of orbit. Maxillary nearly entirely hidden when

mouth is closed. Jaws about equal, with a narrow band of small fixed conical teeth, palate toothless. Scales ctenoid, regularly arranged, large, 29—33 in a longitudinal series. Lateral line interrupted below middle of dorsal fin and continued lower down. Dorsal with 14—19 spines and 8—11 rays, originating in advance of the anal, which has 14—17 spines and 10—13 rays. Soft dorsal and anal prolonged, pointed, scaly at the base and their rays branched. Caudal elongate, terminating in an obtuse point. Pectorals rounded; ventrals inserted below their base, with a spine and 5 rays, the first of which is produced into two filaments. Operculum without serrature, praeoperculum denticulated. Branchial arches with toothed tubercles.

Distribution: Fresh water fishes of Ceylon, Singapore, Sumatra, Java and Borneo.

1. Polyacanthus hasselti C.V. (Fig. 87, pag. 337).

Polyacanthus hasselti Cuvier & Valenciennes, Hist. nat. Poissons VII. 1831, p. 353.
Polyacanthus Kuhlii Bleeker, Nat. & Geneesk. Arch. Ned. Indië II. 1845, p. 520 (nom. tant.).
Polyacanthus Hasselti Bleeker, Verh. Bat. Gen. XXIII. 1850, Vissch. Doolhofv. kieuw., p. 9.
Polyacanthus Einthovenii Bleeker, Nat. Tijdschr. Ned. Ind. II. 1851, p. 423.
Polyacanthus Helfrichii Bleeker, ibid. VIII. 1855, p. 162.
Polyacanthus hasselti Günther, Cat. Brit. Mus. III. 1859—1861, p. 378.
Polyacanthus Hasseltii Bleeker, Atl. ichth. IX. 1877, tab. 396, Osphrom. tab. II. fig. 7.
Polyacanthus Hasseltii Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 12.
Polyacanthus Hasseltii Vaillant, Nouv. Arch. Mus. Hist. Nat. (4) V. 1893, p. 102.
Polyacanthus hasseltii Regan, Proc. Zool. Soc. London 1909, p. 772.

D. XVI—XIX. 10—13; A. XV—XVII. 11—13; P. 2.11—12; V. I. 5; L.l. 31—33; L.tr. ca. $\frac{7}{12}$.

Height in adult about 2.5, 3.5 in length with caudal. Head somewhat obtuse, 3.7 and 4.7 in same lengths. Eye more or less than 4 times in head, nearly equal to snout, which is strongly convex as also interorbital space, the width of which is more than $^1/_3$ the length of the head. Cleft of mouth reaches to vertical from between nostrils. Praeorbital not or only slightly serrated. Praeoperculum more or less denticulated in its lower half. Soft dorsal and anal and filaments of ventrals less produced in young specimens. Dark olivaceous, somewhat lighter below, in young sometimes with dark transverse bands; soft dorsal sometimes with a diffuse blackish spot at its base.

Membrane between dorsal, anal and caudal rays reticulated or spotted. Length 195 mm.

Nom. indig.: Tambakan, Katoprak (Malay, Batavia), Salintja (Djambi, Palembang), Belontja (Palembang).

Habitat: Singapore; Sumatra (Palembang!, Bagan Api Api!, Gunung Sahilan!, Laut Tador, Sungei Mahe, Sungei Si Russi, River Kwantan, Upper and lower Langkat, Danau baru, Indragiri, Djambi!, Muarah Kompeh); Java (Batavia!); Borneo (Banjermassin, Kahajan, river Kapuas, Lake Danau Sriang, Sebruang, Pontianak, Montrado, Sinkawang, Sambas, Seminis, Mandhor).

In rivers and ponds.

3. Helostoma Cuvier.

(G. Cuvier, Règne Anim. 2ième édit. Vol. II. 1829, p. 228, Cuvier & Valenciennes, Hist. nat. Poiss. VII. 1831, p. 341).

Compressed, oblongly-oval. Mouth protractile; its cleft horizontal, very small, ending far distant from orbit. Jaws equal, with thick lips, provided with some series of small, moveable,

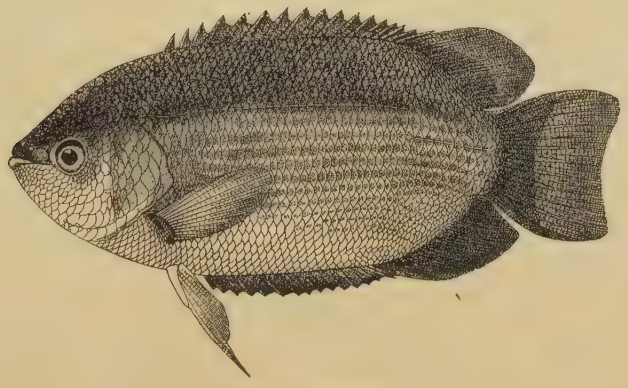

Fig. 88. *Helostoma temmincki* C.V. × 1/3.

generally black-tipped teeth; other teeth are wanting. Praeorbital serrated. Scales ciliated, regularly arranged, of moderate size; lateral line interrupted below soft dorsal, continued lower down. Dorsal with 16—18 spines [1]) and 13—16 rays, its origin in advance of that of anal, which has 13—15 spines and 17—19 rays. Soft dorsal and anal obtusely rounded and

1) An abnormal specimen with D. XII. 14 and A. VIII. 17, was described by Bleeker as *H. oligacanthus* (vide infra).

higher than spinous part, scaly at the base, with branched rays. Anal not or only slightly emarginate. Pectorals obtusely rounded; ventrals inserted below their base, with a strong spine and five rays, the first of which is bifid and somewhat prolonged. Operculum and praeoperculum entire. Branchial arches without toothed tubercles.

Distribution: That of the single species known.

1. Helostoma temmincki C.V. (Fig. 88, pag. 339).

Helostoma Temminckii Cuvier & Valenciennes, Hist. Nat. Poiss. VII. 1831, p. 342.
Helostoma tambakkan Bleeker, Nat. & Geneesk. Arch. Ned. Indië II. 1845, p. 520 (nom. tant.).
Helostoma oligacanthum Bleeker, ibid. (spec. abnorm.).
Helostoma Temminckii Bleeker, Verh. Bat. Gen. XXIII. 1850, Vissch. doolhofv. Kieuw. p. 9.
Helostoma temminckii Günther, Cat. Brit. Mus. III. 1859—1861, p. 377.
Helostoma Temmincki Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 15.
Helostoma temmincki Regan, Proc. Zool. Soc. London 1909, p. 773.

D. XVI—XVIII. 13—16; A. XIII—XV. 17—19; P. 2. 11; V. I. 5; L.l. 44—48; L.tr. $\frac{8}{15—16}$.

Height about 2, about 2.5 in length with caudal. Head, with the fronto-rostral line more or less concave, 2—3 in length, 3—3.5 in length with caudal. Eye on the same level with the angle of the mouth, 3.5 to about 4 times in head and nearly equal to snout. Olivaceous or greyish on the back, much lighter below, dark longitudinal stripes along the series of scales. Length 300 mm.

Nom. indig.: Tambakan (Malay), Tabakang (Djambi), Sapil (Palembang), Biawan (Kapuas).

Habitat: Sumatra (Palembang!, Bagan Api Api!, River Batang Hari!, Djambi!, Danau Gading, Danau Sialong Lotong, Indragiri, Gunung Sahilan!, Deli!, Sungi Glugur!, Lower & Upper Langkat!, Padang, Pangabuan, Benkulen, Telokbetong); Java (Batavia!); Borneo (river Kapuas: Lake Danau Sriang, Pontianak, Sintang, Smitau, Sebruang, Djongkong!; river Kahajan, Banjermassin). — Siam, Malay Peninsula [1]).

Living in fresh water and ponds; a valued foodfish.

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1) Károli (Termeszetrajzi Füzetek V. 1882, p. 26) records also Ceylon as habitat, but this must be erroneous as the species has never been found in Ceylon.

4. Trichogaster Bloch, Schneider.

(Bloch, Schneider, Syst. Ichth. 1801, p. 164).
Colisa Cuvier & Valenciennes, Hist. nat. Poissons VII. 1831, p. 359.

Compressed, oblong. Mouth small, slightly protractile. Cleft of mouth oblique; maxillary reaching to about vertical through anterior nostrils. Lips moderate or thick. Lower jaw prominent. Bands of fixed, generally minute teeth in jaws; vomer and palatines edentulous. Praeorbital serrated. Scales ctenoid, large, regularly arranged; lateral line sometimes absent, or vestigial, formed by pores in the centre of the scale only or by tubes in an interrupted line, the posterior part of which is situated lower down, both parts may be connected by 1 to 4 pierced scales. Dorsal long, its origin above or in advance of that of anal, its spinous part longer than its soft, pointed or rounded part, with 15 to 19 more or less increasing spines and 6 to 14 rays. Anal with 14 to 22 spines and 11—20 branched rays, scaly at its base. Caudal rounded, truncate or slightly emarginate. Pectorals rounded or pointed. Ventrals inserted in advance of them, consisting of a single elongated filamentous ray and a rudimentary spine. Operculum entire, praeoperculum usually serrated.

Distribution: Singapore, Borneo, British India, Assam and Burmah.

In rivers.

Synopsis of the indo-australian species.

1. Anal scaly at the base only; lateral line 29—31 . . . . *Tr. fasciatus* p. 341.
2. Anal densely scaly, the scales covering the fin to the tips of the posterior spines, lateral line 27—28 . . . . *Tr. lalius* p. 342.

1. Trichogaster fasciatus Bl. Schn.

Trichogaster fasciatus Bloch, Schneider, Syst. Ichth. 1801, p. 164.
Trichopodus colisa Hamilton Buchanan, Fishes Ganges 1822, p. 117 & 372.
Trichopodus bejeus Hamilton Buchanan, ibid. p. 118 & 372.
Trichopodus cotra Hamilton Buchanan, ibid. p. 119 & 372.
Colisa vulgaris Cuvier & Valenciennes, Hist. Nat. Poiss. VII. 1831, p. 362.
Colisa bejeus Cuvier & Valenciennes, ibid. p. 365.
Colisa cotra Cuvier & Valenciennes, ibid. p. 366.
Polyacanthus fasciatus Cuvier & Valenciennes, ibid. p. 369.
Colisa ponticeriana Cuvier & Valenciennes, ibid. p. 370.
Colisa vulgaris Bleeker, Verh. Batav. Genootsch. XXV. 1853, Visschen Bengalen en Hindostan, p. 94.

Trichogaster fasciatus Günther, Cat. Brit. Mus. III. 1859—1861, p. 387.
Trichogaster fasciatus Day, Fishes of India, 4°. 1878—1888, p. 374.
Trichogaster fasciatus Vinciguerra, Ann. Mus. Civ. Genova. (2) IX. 1890, p. 187.
Trichogaster fasciatus Regan, Proc. Zool. Soc. London 1909, p. 785.

D. XV—XVII. 9—14; A. XV—XVIII. 14—19; P. 10; V. 1; L.l. 29—31; L.tr. ca. $16^1/_2$.

Height $2^2/_3$—$3^1/_4$, head $3^3/_4$—$4^1/_4$ in length with caudal. Diameter of eye $3^1/_4$—$3^1/_2$ in head, about equal to snout and much shorter than interorbital space. Soft dorsal and anal rounded or somewhat pointed and longer than last spine, both fins scaly at the base only. Caudal notched or truncate. Greenish above, whitish below, numerous orange or bluish bars descending obliquely downwards and backwards from back to anal; a green spot on gillcover; vertical fins spotted, anal edged with red. Length 125 mm. [No specimens from our faunal region seen by us].

Habitat: Singapore (British Museum, see note). — Northern India, Assam and Upper Burma.

In rivers and estuaries.

Note. About the specimen from Singapore in the British Museum Mr. J. R. NORMAN was so kind to inform us, that it was from an aquarium and that it was supposed to come from Singapore but may have been imported. Under these circumstances the locality cannot be trusted.

2. **Trichogaster lalius** (Ham. Buch.)

Trichopodus lalius Hamilton Buchanan, Fishes Ganges 1822, p. 120 & 372.
Colisa lalius Cuvier & Valenciennes, Hist. nat. Poissons VII. 1831, p. 366.
Colisa unicolor Cuvier & Valenciennes, ibid. p. 368.
Trichogaster unicolor Günther, Cat. Brit. Mus. III. 1861, p. 388.
Trichogaster lalius Day, Fish. India 4°, 1878—1888, p. 375.
Trichogaster lalius Regan, Proc. Zool. Soc. London 1909, p. 786.

D. XV—XVII. 7—10; A. XVII—XVIII. 13—17; P. 10; V. 1; Sq. lat. 27—28; L.tr. ca. 15.

Height $2^1/_3$ to $2^3/_4$, head $3^1/_3$ to $3^1/_2$ in length with caudal. Diameter of eye $3^1/_4$ to $3^1/_2$ in head, shorter than snout. Soft dorsal, anal and caudal rounded; anal densely scaly, the scales covering the fin to the tips of the posterior spines. Body scarlet, crossed by somewhat oblique bands of pale blue, fins with scarlet spots or bars, anal with a red margin. Length 50 mm. [After DAY and REGAN, not seen by us].

Habitat: Borneo (Baram river, after C. POPTA [1])). Ganges and Jumna rivers, Sind, Cachar, Assam.

In rivers.

5. Osphronemus Lacépède.

(LACÉPÈDE, Hist. nat. Poiss. III. 1802, p. 116).

Osphromenus Cuvier & Valenciennes, Hist. nat. Poiss. VII. 1831, p. 377.

Strongly compressed, oblong, elevated. Mouth protractile, small, oblique. Jaws subequal, when old chin prominent. Praeorbital serrated. Bands of small, conical, fixed teeth in the jaws, larger in the exterior series. Scales large, ciliate, those on the head with a rough hindborder only, regularly arranged; lateral line formed by an uninterrupted series of tubes. Dorsal

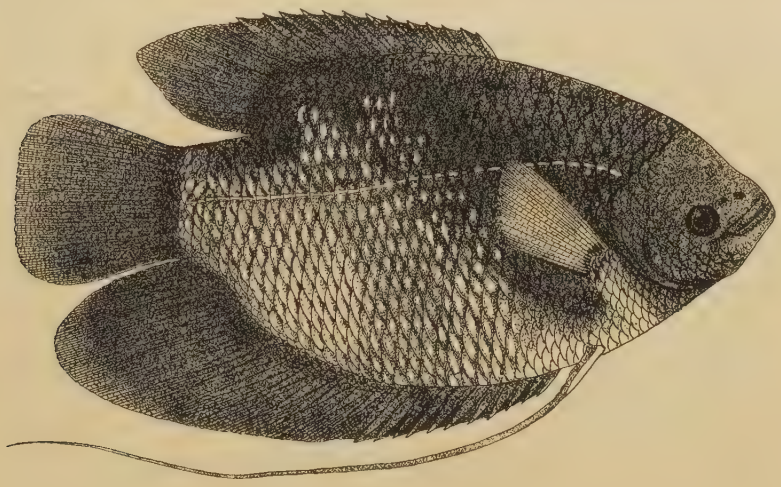

Fig. 89. *Osphronemus goramy* Lac. × 1/4.

with 12—13 spines and 11—13 rays, originating far behind base of pectorals and above or behind origin of anal, which has 9—11 spines and 19—21 rays. Dorsal and anal spines increasing in size. Soft dorsal and anal more or less obtusely rounded and produced, their base without scales and their rays simple. End of soft dorsal far before that of soft anal, which is connected with the base of the truncate or slightly convex caudal. Pectorals obtuse; ventrals inserted below their base, consisting of a spine and five rays, the first of which is prod-

1) C. M. L. POPTA, Notes Leyden Museum XXVII. 1906, p. 255.

uced into an undivided, articulated filament. Operculum entire, prae- and suboperculum finely denticulated at their horizontal border.

Distribution: that of the single species known.

1. Osphronemus goramy Lac. (Fig. 89, p. 343).

Osphronemus goramy Lacépède, Hist. Nat. Poissons III. 1802, p. 116 & 117.
Osphromenus olfax Cuvier & Valenciennes, Hist. Nat. Poiss. VII. 1831, p. 377.
Osphronemus satyrus Bleeker, Nat. & Geneesk. Arch. Ned. Indië II. 1845, p. 519.
Osphromenus olfax Cantor, Journ. Asiat. Soc. Beng. XVIII. 1850, p. 1070.
Osphromenus olfax Bleeker, Verh. Bat. Gen. XXIII. 1850, Vissch. doolhofv. kieuw. p. 10.
Osphromenus olfax Günther, Cat. Brit. Mus. III. 1859—1861, p. 382.
Osphromenus olfax Day, Fishes of India 4°, 1878—1888, p. 372.
Osphromenus olfax Bleeker, Atl. ichth. IX. 1877, tab. 395 & 396, Osphrom. tab. I, fig. 6, tab. II, fig. 6.
Osphromenus olfax Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 17.
Osphromenus gourami Regan, Proc. Zool. Soc. London, 1909, p. 774.

D. XII—XIII. 11—13; A. IX—XI. 19—21; P. 2, 13—14; V. I. 5; L.l. 30—33; L.tr. $\frac{5—6}{13—14}$.

Height in large specimens nearly twice the length of the head, which goes about 3.4 in length, 4.3 in length with caudal; head in young acute, in adult obtuse; rostro-frontal line concave, in adult nearly straight. Mandible increasing in height with age and getting a prominent chin. More or less brownish, olivaceous above, silvery or yellowish below. In young with about 8 darker crossbands; a dark spot with yellow or silvery outer circle above the soft anal and a blackish spot at the base of the pectoral. Length up to 500 mm.

Nom. indig.: gurami (indig. et sinens. Ind. Orient.), Kalui (Djambi), Ikan kali (Palembang).

Habitat: Sumatra (Palembang, Batang Hari!, Djambi!, Taluk!, Lahat, Gunung Sahilan!, Sidjundjung!, Padang Pandjang, Singkarah!, Lake of Singkarah!, Kuala Lumpur, Laut Tador, riv. Selapian, Deli!, Siboga, Padang, Pajakombo, Solok, Meninjau, Benkulen); Java (Batavia!, Buitenzorg!, Bantam, Tjipanas, Tjandjur); Madura; Borneo (Sambas, river Kapuas, Sintang, river Mahakam, upper coarse and upper and lower coarse of river Bo, Baram river, Banjermassin). — Siam, Ceylon, Pinang, Malakka, naturalized in Seychelles and Australia.

An excellent foodfish introduced and naturalized in various

tropical countries. Able to live in rivers and ponds, even in somewhat brackish water, but thriving best in shallow, weedy ponds; rising to the surface to respire air. When breeding, the fish takes care of its young. The eggs are attached to water plants or received in a nest, composed of plants. The gourami is essentially a vegetable feeder, but he feeds also on insects, fish and decomposed matter.

6. **Macropodus** Lacépède.

(Lacépède, Hist. Nat. Poiss. III. 1802, p. 416 & 417).
Polyacanthus Cuvier & Valenciennes, Hist. Nat. Poissons, VII. 1831, p. 353 (p.p.).
Macropus Günther, Cat. Brit. Mus. III, 1859—1861, p. 381.
Pseudosphromenus Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 17.

Compressed, oblong. Mouth slightly protractile, its cleft small, oblique; maxillary not reaching orbit. Praeorbital serrated. Jaws with small, fixed conical teeth; palate edentulous. Scales ciliated, rather large, regularly arranged; lateral line indicated by an incomplete series of scales with a hole in the centre or absent. Dorsal with 13—17 spines and 5—8 rays, its origin nearly above that of anal which has 16—20 spines and 9—15 rays. Soft dorsal and anal with branched rays, the posterior more or less prolonged. Both fins with a scaly sheath at the base. Caudal forked, the lobes produced. Pectorals rounded. Ventrals inserted below base of pectorals, with a spine and 5 rays, the exterior of which are elongate. Part of prae-, sub- and interopercle finely serrated.

Distribution: Pulu Weh near Sumatra, Malay Peninsula, British India, Ceylon and China, Cochin China, Loo Choo Islands, Formosa.

In lowland streams, estuaries, shallow waters within or not far removed from tidal influence, living at the surface of the water, occasionally near the bottom, from where they rise to breath air. Though they are vegetable feeders they are reported to be effective musquito-destroyers.

Key to the indo-australian species of Macropodus.

1. Anal with 9—12 rays. Fins scaleless, except for the basal sheath. Operculum without black spot. . . . . *M. cupanus* p. 346.
2. Anal with 11—15 rays. Small scales on the fins in addition to the basal sheath. A black spot on operculum. *M. opercularis* p. 346.

1. Macropodus cupanus (C. V.)

Polyacanthus cupanus Cuvier & Valenciennes, Hist. Nat. Poiss. VII. 1831, p. 357.
Polyacanthus cupanus Günther, Cat. Brit. Mus. III. 1861, p. 381.
Polyacanthus cupanus Kner, Fische Novara Exp. 1865—1867, p. 218.
Polyacanthus cupanus Day, Fishes of Malabar 1865, p. 134.
Polyacanthus cupanus Day, Fishes of India 4°, 1878—1888, p. 371.
Macropodus cupanus Regan, Proc. Zool. Soc. London 1909, p. 775.

D. XIII. 6—7 or XIV. 6—7; A. XVII—XVIII. 11—12 or XIX. 11; P. 11—12; V. I. 5; L.l. 30—31; L.tr. $10^1/_2$.

Height about 3.4, head 2.9—3 in length. Rostro-dorsal profile convex. Eye ca. 3.1 in length of head, about 1.4 in postorbital part of head and nearly equal te slightly convex interorbital space. Snout much shorter than eye, maxillary reaching to vertical through space between nostrils. Praeorbital strongly serrated. Origin of dorsal about opposite origin of anal, with a basal sheath of two series of alternating scales. Soft dorsal and anal pointed, their penultimate rays being produced on first third of caudal, which is also pointed. Pectorals shorter than head without snout. Height of caudal peduncle near base of caudal somewhat shorter than postorbital part of head. Alcohol specimens brown, lighter below; there may be a darker band from snout through eye on operculum, and continued, less pronounced, to base of caudal, which may carry a faded dark spot, sometimes above dark lateral band, a lighter one. Length 48 mm.

Habitat: Lake Anak laut, on Pulu Weh near Sumatra!. — British India, Malay Peninsula.

Note. There are some differences between our specimens and those of DAY and REGAN, especially in the dorsal and anal. We find the fin-formula D. XIII—XIV. 6-7, A. XVII—XIX. 11—12; according to KNER it is D. XIV—XV.5—6, A. XVII—XIX.9—11; according to DAY and REGAN D. XIV—XVII. 5—7, A. XVI—XIX. 9—11. But these differences seem to us to be too small to doubt the specific identity.

2. Macropodus opercularis (L.).

Labrus opercularis Linné, Amoen. Academ. IV. 1788, p. 428.
Chaetodon chinensis Bloch, Ausländ. Fische IV. 1790, p. 5; Taf. CCXVIII, Fig. 1.
Chaetodon chinensis Bloch, Schneider, System. ichthyol. 1801, p. 234.
Labrus opercularis Bloch, Schneider, ibid. p. 245.
Chaetodon chinensis Lacépède, Hist. nat. Poissons, IV. 1802, p. 461, 496.
Macropodus viridi-auratus Lacépède, ibid. p. 416, 417.

Polyacanthus chinensis Cuvier & Valenciennes, Hist. nat. Poiss. VII, 1831, p. 357.
Macropodus viridi-auratus Cuvier & Valenciennes, ibid. p. 373.
Macropodus venustus Cuvier & Valenciennes, ibid. p. 375.
Macropodus ocellatus Cantor, Ann. Mag. nat. hist. IX, 1842, p. 484.
Polyacanthus paludosus Richardson, Ichth. China, Report British Associat. (1845) 1846, p. 250.
Polyacanthus opercularis Richardson, l.c.
Polyacanthus opercularis Günther, Cat. Brit. Mus. III. 1859—61, p. 379.
Macropus viridi-auratus Günther, ibid. p. 382.
Pseudosphromenus opercularis Bleeker, Verh. Akad. Amsterdam, XVIII, 1879, Poiss. Chine, p. 2.
Polyacanthus opercularis Max Weber, Zool. Ergebn. Reise Nied. Ost-Indien, III, 1894, p. 418.
Macropodus opercularis Tate Regan, Proc. Zool. Soc. London 1909, p. 774.

D. XIII—XIV. 8—9; A. XVII—XX. 11—12; P. 11; V. 1.5; L.l. 28 (31)—30 (33); L.tr. 13—14.

Height 2.7 to nearly 3, head 3 or somewhat more in length. Rostro-dorsal profile declivous, somewhat concave on head. Eye 3.2—3.5 in length of head, 1.5 to 1.7 in its postorbital part and less than flat interorbital space, which goes 2.6 to 2.8 in head. Snout much shorter than eye. Maxillary reaching vertical through space between nostrils. Praeorbital serrated. Origin of dorsal about opposite to that of anal, which has small scales in addition to basal sheath of 2 series of larger scales. Soft dorsal and anal pointed or strongly produced, in which case the otherwise pointed caudal is bilobed. Pectorals slightly shorter than head without snout. A round black spot, bordered with white, on extremity of operculum; light brown with dark cross-bars. Length 60 mm.

Habitat: Highlands of Padang, Sumatra or West Java! — China, Cochin China, Formosa, Loo Choo Islands.

Note: There is much uncertainty about the occurrence of this species in the Archipelago. It was for the first time recorded from there by one of us, who acquired 8 specimens, together with *Osphromenus goramy* and *Trichopodus trichopterus* in West Java or more probably in the Highlands of Padang, Sumatra. Unfortunately this was the only batch of fishes of the extensive collection, made there, of which the label was lost (see M. WEBER l. s. c. p. 418). *Macropodus opercularis* has since then (1888) never been rediscovered, neither in Sumatra, nor in Java, nor elswhere in the Archipelago. We doubt therefore more than ever its occurrence in a free state in the

Archipelago. Possibly the specimens collected in 1888, most probably in Sumatra, were introduced as this species is kept in captivity f. i. in Singapore.

7. Parosphromenus Bleeker.

(Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 19).

Compressed, oblong. Cleft of mouth oblique, not reaching orbit. Jaws equal, with small, conical, fixed teeth. Scales ctenoid, large, regularly arranged; lateral line inconspicuous. Dorsal with 13 spines and seven rays, originating somewhat behind branchial opening and ending far before origin of caudal, the spines increasing in size, the soft part being much higher and acute. Anal with 13 spines and 8 rays, originating about below 3rd dorsal spine and reaching as far as dorsal, which it otherwise equals. Caudal obtusely rounded as also pectorals. Below their base originate the acute ventrals, with a spine and 5 rays, the first of which is produced into a filament, which nearly reaches anal. Angle of praeoperculum slightly denticulate; the other opercular bones and praeorbital edentulous. [After Bleeker].

Distribution: that of the single species known.

1. Parosphromenus deissneri (Blkr.).

Osphromenus Deissneri Bleeker, Nat. Tijdschr. Ned. Indië XVIII. 1859, p. 376.
Polyacanthus deissneri Günther, Cat. Brit. Mus. III. 1861, p. 381.
Parosphromenus Deissneri Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 20.
Parosphromenus deissneri Regan, Proc. Zool. Soc. London 1909, p. 775.

D. XIII. 7; A. XIII. 8; P. 11; V. I. 5; L.l. 30; L.tr. ca. 10.

Height $4^1/_2$, head ca. 4 in length with caudal. Head acute, its rostro-frontal line declivous. Rose coloured; a blackish line below base of dorsal and above base of ventral; two broader black longitudinal bands on each side continued on caudal, lower part of side of head black-spotted. Length of single specimen known 34 mm. [After Bleeker, not seen by us].

Habitat: Banka, river Baturussak.

8. Sphaerichthys Canestrini.

(Canestrini, Verhandl. zool.-bot. Gesellsch. Wien X. 1860, p. 707).

Compressed, oblong. Mouth protractile, its cleft oblique and very small. Jaws equal, with small, fixed teeth; palate tooth-

less. Scales ciliated, regularly arranged, large; lateral line vestigial. Praeorbital denticulated. Dorsal with 8—12 spines, increasing in size and a soft somewhat produced, acute part formed by 7—10 rays. Origin of dorsal somewhat behind that of anal, which has 8—10 increasing spines and a soft rounded part, ending far behind end of dorsal, near base of caudal connected with it and composed of 18—22 rays, which are branched or not only at their top. Base of anal scaly. Caudal rounded or truncate. Pectorals rounded. The ventrals originate

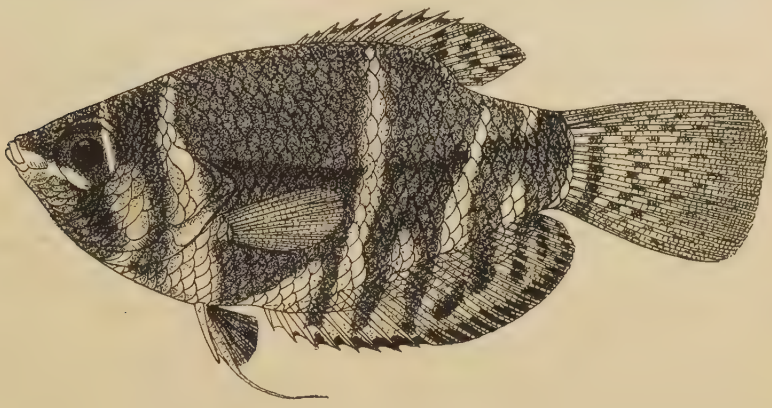

Fig. 90. *Sphaerichthys osphromenoides* Canestr. × 2¼.

slightly before their base, with a strong spine and five rays, the first of which is produced into a filament, reaching soft anal. Horizontal border of praeoperculum denticulated.

Distribution: that of the single species known.

In brooks and rivers.

1. **Sphaerichthys osphromenoides** Canestrini [Fig. 90, p. 349].

Sphaerichthys osphromenoides Canestrini, Verh. zool.-bot. Gesellsch. Wien X. 1860, p. 707.

Osphromenus malayanus Duncker, Mitt. Naturh. Museum Hamburg XXI. 1904, p. 163.

Sphaerichthys osphromenoides Regan, Proc. Zool. Soc. London 1909, p. 776.

D. VIII—XII. 7—10; A. VIII—X. 18—22; P. 8—10; V. I. 5 [1]); Sq. l. 26—29.

1) This is the formula of dorsal and anal given by Regan, who disposed of 2 specimens. The extremes we find among 12 specimens is D. VIII. 8 and XI. 9 and A. VIII. 21 and IX. 19. We never found XII spines in D. and X spines in A. as first mentioned by Canestrini.

Height about twice, 2.6 in length with caudal. Head pointed, rostro-frontal line somewhat concave, about thrice in length, 3.8 in length with caudal. Eye about thrice in head. For other details see genus. Preserved specimens brownish with variable silvery crossbands. Usually the first from occiput to base of ventrals; the second from spinous dorsal to spinous anal, the third crossing caudal peduncle to soft anal; it may be followed by an incomplete one. Sometimes a white stripe runs from snout through eye and a vertical one through hind-part of eye. Anal with a black border, soft dorsal and caudal with or without blackish spots. Ventrals black. Length 50 mm.

Habitat: Sumatra (Bagan api api!, River Batang Hari, Djambi!, Taluk!, Gunung Sahilan!). — Malay Peninsula (Kuala Lumpur, Negri Sembelan), "Indien" (CANESTRINI).

In rivers and brooks.

9. Ctenops Mc Clelland.

(Mc CLELLAND, Journ. Nat. Hist. Calcutta V. 1844, p. 281).

Trichopsis Canestrini, Verhandl. zool.-bot. Gesellsch. Wien X. 1860, p. 708.

Compressed, oblongly-elongate. Mouth somewhat protractile, its cleft oblique. Intermaxillaries reaching orbit or are far distant from it; lips moderate. Lower jaw prominent. In the jaws a band of small, fixed conical teeth, the outer series of which is larger; none on vomer and palatines. Praeorbital serrated. Scales ciliate, large, regularly arranged. Lateral line a more or less interrupted series of small pores, occasionally more tubular towards the caudal region. Dorsal short, originating behind commencement of soft anal, with 2—7 spines and 6—8 branched rays. Anal scaly at the base, beginning below pectorals, with 4—8 spines and 24—28 rays. Caudal rounded or pointed. Pectorals rounded. The ventrals inserted somewhat in advance of them, with a rather strong spine and five rays, the first of which is produced into a long, simple, articulated filament. Opercular bones entire, only the horizontal limb of praeoperculum serrated.

Fig. 91. *Ctenops vittatus* (C. V.). n.s.

Distribution: India, Cochin China, Siam, Sumatra, Java and Borneo.

In rivers and brooks.

Key to the indo-australian species of Ctenops.

1. Dorsal with 2 to 4 spines; snout shorter than eye; soft dorsal and anal and caudal produced . . . . . *Ct. vittatus* p. 351.
2. Dorsal with 5—7 spines; snout longer than eye; vertical fins not produced. . . . . *Ct. nobilis* p. 352.

1. Ctenops vittatus (C. V.). [Fig. 91, p. 350].

Osphromenus vittatus Cuvier & Valenciennes, Hist. Nat. Poissons, VII. 1831, p. 387.
Trichopus striatus Bleeker, Verh. Batav. Genootsch. XXIII. 1850, Visschen Doolhofv. Kieuw. p. 11. — Nat. Tijdschr. Ned. Indië I. 1850, p. 106.
Osphromenus striatus Günther, Cat. Brit. Mus. III. 1859—1861, p. 386.
Ctenops vittatus Bleeker, Atl. ichth. IX. 1877, Tab. 396, Osphrom. tab. 2, fig. 4. — Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 24.
Ctenops vittatus Regan, Proc. Zool. Soc. London 1909, p. 776.

D. II—IV. 6—8; A. VI—VII. 24—28; P. 9; V. I. 5; Sq. lat. ca. 28; L.tr. 13.

Height $2^3/_4$ to about thrice in length without caudal. Head of about same length, acute, rostro-frontal line concave. Diameter of eye about $3^1/_2$ in head, longer than snout. End of intermaxillaries far distant from orbit. Dorsal and anal spines feeble, soft dorsal and anal and caudal produced into a point. Ventral filament equal to head or much longer. Lateral line an interrupted series of small pores. Body with 2—4 dark longitudinal stripes; two from eye to base of caudal, the upper one interrupted by a humeral dark spot, which may be preceded by a light spot; caudal, dorsal and posterior part of anal sometimes darkspotted. In young specimens usually two black spots on base of caudal. Length 60 mm.

Nom. indig.: Tjupang, Sepat-anatih (Malay, Batavia), Pettek (Sund.).

Habitat: Sumatra (Palembang, Djambi!, Gunung Sahilan!, Pagar alam!); Java (Batavia!, Buitenzorg!, Lebak, Tjampea, Tjandjur, Bandung, Lelles); Borneo (Banjermasin, Sintang, Sadong). — Cochin-China, Siam.

In brooks and rivers.

Doubtful species.

2. Ctenops nobilis Mc Clell.

Ctenops nobilis Mc Clelland, Calcutta Journ. Nat. Hist. V. 1844, p. 281.
Osphromenus nobilis Day, Proc. Zool. Soc. London 1869, p. 519.
Osphromenus nobilis Day, Fish. India 4°. 1878—1888, p. 372.
Osphromenus nobilis Vaillant, Nouv. Arch. Mus. Hist. nat. Paris (4) V. 1893, p. 102.
Ctenops nobilis Regan, Proc. Zool. Soc. London, 1909, p. 777.

D. V—VII. 7—8; A. IV—V. 24—28; P. 12; V. I. 5; L.l. 29—33; L.tr. $\frac{6}{12}$.

Height $2^1/_3$ to 3 in length without caudal; head acute, rather depressed, considerably shorter. Diameter of eye $3^1/_2$ in head, shorter than snout. End of intermaxillaries opposite to frontborder of orbit. Dorsal and anal spines rather strong, soft dorsal, anal and caudal not produced, rounded. Ventral filament prolonged in some specimens but not longer than head. Lateral line, when present, in the form of a simple orifice in the centre of each scale; occasionally it becomes more tubular toward the caudal region. Brownish, with darker stripes along the series of scales and with scattered blackish spots; a silvery white stripe, more or less interrupted, from eye to base of caudal; below it two similar stripes or series of oblong spots; fins with small dark spots; an ocellus on the upper part of the base of the caudal. Length at least up to 100 mm.

Habitat: ?Borneo (river Sebruang) [VAILLANT]. — Rivers of N. E. Bengal and Assam.

Note: VAILLANT (l. c.) who described 6 young specimens of 31 mm. length is not sure about his definition. We doubt its correctness, as he found the fin-formule D. VII. 7; A. XI. 18, thus quite different from the anal of *Ct. nobilis*, though the total number of spines and rays is about equal. An other difference in his description are "une dizaine de raies transversales zèbrent le corps, elles sont surtout distinctes dans leur moitié inférieure".

10. Betta Bleeker.

(BLEEKER, Verh. Bat. Genootsch. XXIII. 1850, Vissch. Doolhofv. Kieuw. p. 12).
Parophiocephalus Popta, Notes Leyden Mus. XXV. 1905, p. 184 and ibid. XXVI. 1906, p. 9 (p.p.).

More or less compressed, elongate. Mouth protractile, its

cleft small, oblique; maxillary extending beyond middle of eye, to its frontborder or usually not so far. Mandibles prominent. Praeorbital entire. Jaws with a band of small, fixed, conical teeth; none on palate. Scales ciliate, large, regularly arranged. Lateral line an interrupted series of small pores in the centre of the scales. Dorsal short, acute or rounded, with or without a single spine and with 7—10 rays, some of which may be strongly produced; inserted far behind middle of length (without caudal). Anal long, with or without 1—4 spines and with 20—32 soft rays, which are usually not branched or only posteriorly, where they may be produced. Caudal rounded or pointed, its central rays often produced. Pectorals more or

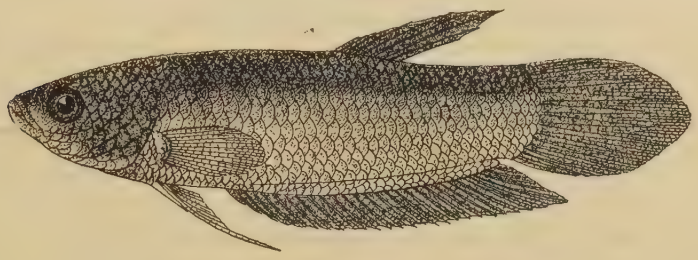

Fig. 92. *Betta anabatoides* Blkr. n.s.
The figure does not show the dark lines along the transverse series of scales.

less pointed. Ventrals inserted below or in advance of pectorals, with an usually weak spine and five rays, the outermost of which is more or less prolonged. Opercular bones entire.

Distribution: Islands of the Archipelago from Sumatra to Java and Borneo, Malay Peninsula and Siam.

In rivers, brooks, ponds and lakes.

Note. The species of this genus are difficult to distinguish even after the valuable revision of it by TATE REGAN, which was the first attempt to bring order in the former chaotic state of species. Most of them show a confusing variability of characters according to size, sex and locality and seem partly not yet to be fixed. The following key to distinguish them is therefore not very satisfactory.

Key to the indo-australian species of Betta.

1. All the rays of dorsal and anal articulated.
   a. Maxillary extending beyond middle of eye . . . . *B. macrostoma* p. 355.
   b. Maxillary not extending beyond frontborder of eye. *B. unimaculata* p. 355.

II. Anal with 1—4 spines.

A. All rays of dorsal flexible and articulated.

1. Maxillary extending to below nostrils or to frontborder of eye. Origin of D. midway between head and caudal or somewhat nearer to lastnamed.

a. Anal 2.21—24. Origin of D. opposite to 14.—16. lateral scale; 22—26 praedorsal scales; interorbital space 2.4—2.9 in head. Uniform brown . . . . . *B. fusca* p. 356.

b. Anal 1.27. Origin of D. opposite to 16. or 17. lateral scale; about 30 praedorsal scales; interorbital space more than thrice in head. Brownish with darker stripes along longitudinal series of scales . . . . . *B. akarensis* p. 357.

c. Anal 2.25—30. Origin of D. opposite to 17. or 18. lateral scale; 26—28 praedorsal scales; interorbital space ± 2.5 in head. Brown with darker lines along transverse series of scales. *B. anabatoides* p. 357.

2. Maxillary extending to behind frontborder of eye. Origin of dorsal at least one eye-diameter nearer to caudal than to head. Anal 2.27—29. Height of caudal peduncle at base of caudal equal to postorbital part of head. . . . . *B. patoti* p. 359.

B. First dorsal ray a more or less pungent spine.

1. 20—22 praedorsal scales. Anal 1.19—23. Dorsal 1.6—8, its origin much nearer to head than to base of caudal; opposite to 14.—15. lateral scale. Height of caudal peduncle at base of caudal about equal to postorbital part of head. Three longitudinal black bands . . . . . *B. picta* p. 360.

2. 25—30 praedorsal scales.

a. Anal 3.21. Dorsal 1.7, its origin midway between head and caudal; opposite to 16. lateral scale; 28 praedorsal scales. Caudal peduncle at base of caudal equal to postorbital part of head. L.l. 30. Five to six dark vertical bands on pale ground colour. . . . . *B. rubra* p. 361.

b. Anal 2.20—25. D. 1.7—9, its origin nearer to head than to base of caudal; opposite to 14.—16. lateral scale; 25—26 praedorsal scales. Caudal peduncle at base of caudal equal to or longer than postorbital part of

head. L.l. 28—30. Two longitudinal bands united at base of caudal . . . . . *B. taeniata* p. 362.

c. Anal 2.28—30. D. 1.9—10, its origin nearer to caudal than to head; opposite 18. or 19. lateral scale; 28—30 praedorsal scales. Caudal peduncle much longer than postorbital part of head. L.l. 34—36. Six or more dark crossbars on brown ground colour . . . . . *B. fasciata* p. 362.

d. Anal 2.30—32. D. 1.10, its origin nearer to caudal than to head; opposite to 19. or 20. lateral scale; ± 30 praedorsal scales. Caudal peduncle equal to postorbital part of head. L.l. 35. Scales bronze, their anterior half emerald green. . . . . *B. bellica* p. 363.

Doubtful species. . . . . *B. pugnax* p. 364.

1. Betta macrostoma Regan.

Betta macrostoma Tate Regan, Proc. Zool. Soc. London 1909, p. 778.

D. 11; A. 26; L.l. 32.

Rostro-dorsal profile slightly convex. Height 4.1, head pointed, 3 in length. Diameter of eye slightly shorter than snout, about 4.5 in head, 2.5 in postorbital part of head and 1.6 in interorbital space, which goes 2.8 times in length of head. Maxillary extending a little beyond the middle of eye. Origin of dorsal in the middle between head and base of caudal, separated by about 25 praedorsal scales from snout and opposite to 17th lateral scale. Height of caudal peduncle at base of caudal nearly twice in head. Pectorals somewhat shorter than head without snout. Two blackish longitudinal bands from eye to caudal; dorsal with series of dark spots and with a large black ocellus near the base posteriorly; caudal with two blackish cross-bars; other fins dusky. Length of single specimen known 80 mm. [Type in the British Museum seen by us].

Habitat: Borneo (Sarawak!).

In freshwater.

2. Betta unimaculata (Popta).

Parophiocephalus unimaculatus Popta, Notes Leyden Mus. XXVII. 1906, p. 10.
Betta unimaculata Tate Regan, Proc. Zool. Soc. London 1909, p. 779.

D. 7—9; A. 27—30; P. 13; V. 1.5; L.l. 32—33 (35); L.tr. $12^1/_2$.
Height 3.5—4.5; head more than twice to more than thrice

in length. Rostro-dorsal profile slightly convex to nape, from there to snout declivous, the head being somewhat depressed. Eye nearly 4 to 5 in head, nearly twice to more than 2.5 times in postorbital part of head and 1.4 to 1.6 in interorbital space, which is flat and goes about 2.7 to 2.8 in length of head. Maxillary extending about to frontborder of eye. Origin of dorsal nearer to base of caudal than to head, opposite to 18th or 19th lateral scale and separated by about 29 praedorsal scales from snout. Median dorsal rays produced, reaching base of caudal or nearly so. Anal in its posterior third with a basal sheath of 2 irregular rows of scales, anteriorly with four basal scales between the succeeding rays. Its rays gradually increasing in size till the last three and reaching on caudal, which is rounded. Pectorals shorter than head without snout. Height of caudal peduncle at base of caudal about half length of head. Olivaceous or brownish, lighter below, a more or less distinct lighter lateral band; a blackish spot at the base of the caudal. Fins dusky, the median fins with blackish points on the finmembrane. Length 82 mm. [Type of the species seen by us].

Nom. indig.: Matjè and Lewut (River Howong); Usang (River Kajan).

Habitat: Borneo (River Howong!, River Kajan, River Bongon).

3. **Betta fusca** Regan.

Betta fusca Tate Regan, Proc. Zool. Soc. London 1909, p. 780.

D. 8—9; A. 2. 21—24; P. 13; V. 1.5; L.l. 29—32; L.tr. $9^1/_2$.

Rostro-dorsal profile more or less convex, head pointed. Height 3.2—3.8; head 2.7—3 in length. Eye thrice or more in head, its diameter conspicuously longer than snout, about 1.5 in postorbital part of head and somewhat more or less than 1.2 in interorbital space, which goes 2.4—2.9 times in length of head. Maxillary extending to below posterior nostril. Origin of dorsal midway between head and base of caudal, opposite to 14th or 16th lateral scale and separated by 22—26 praedorsal scales from snout. Longest, median dorsal rays not reaching caudal. Anal with a basal sheath of a single regular series of rather large scales or some smaller ones may be interpolated. Penultimate anal rays produced, reaching halfway caudal, which is rounded and has the central rays produced. Pectorals equal to or somewhat shorter than head. Height of

caudal peduncle more or less than twice in head at base of caudal. Colour of alcohol specimens uniform reddish brown or the back darker; scales more or less with dark edges. A dark longitudinal band through the eye, which may increase on operculum, so as to colour it and the branchial membrane deep dark brown; membrane of fins dusky or blackish as also a crossbar on pectorals near their base. Length 82 mm. [Type in the British Museum seen by us].

Habitat: Island Singkep!; Sumatra (Upper Langkat!). — Malay Peninsula (Perak!).

4. **Betta akarensis** Regan.

Betta akarensis Tate Regan, Proc. Zool. Soc. London 1909, p. 779.

D. 8; A. 1.27; P. 13; V. 1.5; L.l. 31.

Rostro-dorsal profile slightly convex. Height 3.5, head 3 in length. Eye 3.2 in head; its diameter longer than snout, 1.7 in postorbital part of head and about equal to interorbital space, which goes 3.2 times in head. Maxillary extending to below posterior nostril. Origin of dorsal midway between head and base of caudal, separated by about 30 praedorsal scales from snout and opposite to 16th or 17th lateral scale. Base of anal with a sheath of one row of scales. Pectorals somewhat longer than head without snout. Height of caudal peduncle 1.8 in length of head and equal to length of its postorbital part. Brownish, with darker stripes along the series of scales; a dark longitudinal band on the head, passing through the eye; fins dusky. Length of single specimen known 52 mm. [Type of the species in the British Museum seen by us].

Habitat: Borneo (Sarawak, river Akar!).

5. **Betta anabatoides** (Fig. 92, p. 353).

Betta anabatoides Bleeker, Nat. Tijdschr. Ned. Indië I. 1850, p. 269.
Betta picta Bleeker, Atl. ichth. IX, 1877, tab. CCCXCV. Osphrom. tab. 1, fig. 3. — Verh. Akad. Amsterdam XIX. 1879, Poiss. pharyng. labyrinth. p. 26.
? *Betta pugnax* Volz, Zool. Jahrb. Abt. Syst. XIX. 1903, p. 373.
? *Betta pugnax* Fowler, Proc. Acad. Nat. Sci. Philad. (2) LVII. 1905, p. 504.
Betta anabatoides Tate Regan, Proc. Zool. Soc. London 1909, p. 780.
Betta Bleekeri Tate Regan, l. c.

D. 8—10; A. II. 25—30; P. 13; V. I. 5; L.l. 31—34; L.tr. $10^1/_2$.

Rostro-dorsal profile more or less straight from dorsal to nape, from there to snout slightly declivous. Height with in-

creasing size 2.6 to 4; head 3 to 3.3 in length. Eye 3.2 to 4.6 (in large specimens) in length of head, in fullgrown specimens about equal to snout; about twice (less in small specimens) in postorbital part of head and more or less than 1.5 times in nearly flat interorbital space, which goes somewhat more or less than 2.5 times in length of head. Maxillary reaching to frontborder of eye. Origin of dorsal midway between head and base of caudal, or somewhat nearer to lastnamed; opposite to 17th or 18th lateral scale and separated by 26—28 (30) praedorsal scales from snout. The 5th to 7th or 8th dorsal ray strongly produced and reaching on caudal. Anal with a basal sheath of one row of small scales, which may increase to $1^1/_2$ or 2 irregular rows, by interpolation of smaller ones. Anal rays, before the 2 or 3 last short ones, increasingly produced, so that they even may reach nearly to end of caudal. Caudal large, its central rays produced. The filamentous lengthening of the median fins varies individually (with sex?) and increases with increasing length of body. Pectorals rather long, about equal to head without snout or slightly shorter. Height of caudal peduncle at base of caudal 1.6—1.8 in head. Head and back darker, otherwise light brown with numerous more or less distinct dark lines, corresponding with the transverse series of scales above anal sheath, usually more accentuated by a series of corresponding dark spots. In small specimens the successive 4th or 5th transverse line may be fainter, what gives the impression of broad, not pronounced dark crossbars; small specimens may also have a broad dark longitudinal band from snout to caudal in the middle of the side. A black spot behind chin. Branchiostegal membrane blackish or isthmus with a blackish patch, which may increase to a band from eye to eye. Fins dusky, but the dorsal may have series of dark spots or longitudinal bands. Length 115 mm. [Specimens of *B. anabatoides* REGAN in the British Museum seen by us].

Nom. indig.: Tempalo (Sumatra, Djambi).

Habitat: Singapore; Sumatra (Bagan Api Api!, Djambi!, Taluk!, Si Djundjung!, Gunung Sahilan!, Lahat); Island Singkep!; Biliton; Banka; Borneo (Sambas, Sarawak, Pontianak!, Knapei!, Sibau!, Banjermassin, Kahajan).

In rivers, brooks and ponds.

Note: A collection of about 150 specimens in the Museums of Leiden and Amsterdam from BLEEKER's collection and

named by him "*B. picta* Blkr.", with the colour faded and mostly in a bad state of preservation, contains specimens belonging without question to *B. picta* C. V. = *B. trifasciata* Blkr. More numerous are the specimens belonging to *B. anabatoides* Blkr. A few of them show still the markings of the dorsal as drawn in the otherwise rather bad figure in BLEEKER's Atl. ichth. on which TATE REGAN founded *B. Bleekeri*. REGAN in his valuable revision of the genus *Betta* not having had the opportunity of seeing the original specimens of BLEEKER, was misled by BLEEKER's figure and his very insufficient description in his last paper (Verh. Akad. Amsterdam XIX. 1879, Poiss. pharyng. labyrinth. p. 26), in which he united his former *B. anabatoides* and *trifasciata* under the name *B. picta*. His diagnosis, taken from 2 different species, was of course erroneous and misleading.

6. Betta patoti [1]) n. sp.

D. 7—8; A. 2.27—29; P. 12—14; V. 1.5; L.l. 33—35; L.tr. $10^1/_2$.

Rostro-dorsal profile from dorsal to nape straight, from there to snout declivous in a straight line or with a slight convexity or concavity. Chin conspicuously prominent. Height 3.7—4.7 according to size. Head 3.1—3.4 in length. Eye 3.4—4.5, its diameter about equal to snout, 1.7 to 2.6 in postorbital part of head and 1.2 to twice in nearly flat interorbital space, which goes 2.5—2.8 in length of head. Maxillary reaching frontborder of eye or somewhat behind it. Origin of dorsal somewhat more or less than one eye-diameter nearer to caudal than to head, separated by 26—29 praedorsal scales from snout, opposite to 19th to 21st lateral scale. The 4th to 6th may be strongly produced; the 5th reaching far on caudal. Anal with a basal sheath of 2—3 usually regular rows of small scales; the hindermost anal rays before the two last may be strongly produced and reaching far on caudal. Caudal large, spoon-shaped, its 2 central rays more or less produced. Pectorals 1.3—1.4 in length of head. Height of caudal peduncle at base of caudal 1.8—2 in length of head, equal to its postorbital part. Head and upper half of body greyish or dark brown, lower half lighter with about 9—12 irregular crossbars above anal. One

1) Named in honour of Mr. W. J. TISSOT VAN PATOT, who send us the fish from Borneo.

or two dark narrow bands crossing isthmus from eye to eye or isthmus and ventral part of gillmembranes dark. A broad dark long blotch behind eye may be present as also a light and dark crossband at base of caudal. Fins otherwise uniform grey or dusky. One specimen is uniform dark brown, the supra-anal crossbars shining through.

Nom. indig.: Kelatal (Balikpapan), Kelatau and Tjampala (by Bandjermassin people at Balikpapan).

Habitat: Borneo (South-eastern Borneo!, Balikpapan!, river Mangar near Balikpapan!, rivulet 25 K.M. east of Balikpapan bay!, river Bluu!).

7. Betta picta (C. V.)

Panchax pictum Cuvier & Valenciennes, Hist. Nat. Poiss. XVIII. 1846, p. 385.
Betta trifasciata Bleeker, Verh. Bat. Gen. XXIII. 1850, Visschen Doolhofv. Kieuwen, p. 12. — Ibid. Bijdr. fauna Java p. 14. — Nat. Tijdschr. Ned. Indië I. 1851, p. 107.
Betta trifasciata Günther, Cat. Brit. Mus. III. 1861, p. 388.
Betta picta Bleeker, Atl. ichth. IX. 1877, tab. CCCXCV, fig. 3. Osphr. tab. 1, fig. 3.
Betta picta Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng labyrinth. p. 26 (p. p.).
Betta trifasciata Tate Regan, Proc. Zool. Soc. London 1909, p. 781.
Betta macrophthalma Tate Regan, l. c.

D. 1.6—8; A. 2.18—22; P. 12; V. 1.5; L.l. 28—30; L.tr. $9^1/_2$—$10^1/_2$.

Rostro-dorsal profile more or less convex. Head pointed. Eye 3—3.4 in head; its diameter conspicuously longer than snout, 3—3.4 in postorbital part of head and equal to or somewhat shorter than the flat interorbital space. Maxillary extending about to vertical through posterior nostril. Origin of dorsal usually nearer to head than to base of caudal, opposite to 14th—15th lateral scale and separated by 20—24 praedorsal scales from snout. Second or third penultimate rays more or less produced and then reaching root of caudal. Anal with a low basal sheath of one series or two irregular series of scales; its posterior rays preceding the last more or less produced, reaching on anterior third of caudal. Caudal rounded or pointed, the middle rays being produced. Pectorals rounded, 1.6—1.7 in length of head. Height of caudal peduncle at base of caudal 1.7—2 in length of head. Colour variable. Yellowish to lighter or darker brown. Back darker. Belly often reddish. According to state of preservation, sexual maturity and probably also locality the colouration is influenced. There are always present 3 dark longitudinal stripes, sometimes produced by black edges

of the scales, on one continuous series of scales. The middle one runs from base of caudal, where it often begins with a round patch, through eye to snout, from where it is usually continued as a dark band along the chin to the other side. The superior band commences on operculum and runs to caudal, the inferior from below base of pectoral to caudal, anteriorly usually continued as a series of a few black points to hindborder of eye. A transverse band crosses the isthmus and connects the lower border of the eyes, it may be missing or obsolete. In Sumatran species the underside of head is more or less blackish. Pectorals near base with or without a transverse band. Inner rays of ventrals blackish, anal and caudal with or without a black margin, sometimes with one or more series of elongate spots. Dorsal with or without dark longitudinal points, which may constitute longitudinal bands. Length 48 mm., by exception 55 mm.

Habitat: Singapore; Sumatra (Deli!, Upper Langkat!, Palembang, Muara Kompeh); Banka; Biliton; Java (Buitenzorg!, Tjipanas!, Ponds near Trogon!, Tjintjiruan 1600 M. high!, Bandung!, Ambarawa 1500 feet high).

In brooks and ponds.

Note: v. MARTENS (Preuss. Exp. nach Ost. Asien, 1876, p. 395) and KÁROLI (Termeszetr. Füzetek V, 1882, p. 26) mention this species also from Borneo, even from Siam, but we doubt the correctness of these statements. The specimen described by REGAN as *Betta macrophthalma* and presented by Prof. PETERS to the British Museum as *Betta trifasciata*, came from Singapore.

8. **Betta rubra** Perugia.

Betta rubra Perugia, Ann. Mus. Civico Genova (2) XIII. 1893, p. 242.
Betta rubra Tate Regan, Proc. Zool. Soc. London 1909, p. 781.

D. 1.7; A. 3.21; L.l. 30.

Rostro-dorsal profile slightly convex. Height $3^3/_4$, head $3^1/_4$. Diameter of eye $3^2/_3$—4, longer than snout, 1.7 in postorbital part of head and about equal to interorbital space, which goes $3^1/_3$ in head. Maxillary extending to below the posterior nostril. Origin of dorsal midway between head and base of caudal, separated by 28 praedorsal scales from snout, opposite to 16th lateral scale. Penultimate dorsal ray produced and reaching caudal. Anal with a basal sheath, anteriorly of one, posteriorly

of two irregular rows, its hindermost rays somewhat produced. Caudal rounded. Pectorals equal to length of head. Height of caudal peduncle at base of caudal about twice in length of head. Reddish brown, upper half darker, 5 or 6 large dark vertical bars on the lower part of the sides. Length 47 mm. [Cotype in the British Museum seen by us].

Habitat: Sumatra (lake Toba!).

9. **Betta taeniata** Regan.

Betta taeniata Tate Regan, Proc. Zool. Soc. London 1909, p. 781.

D. I.7—9; A. II.20—25; P. 12—14; V. I. 5; L.l. 28—30 (32—33); L.tr. $9^1/_2$—$10^1/_2$.

Rostro-dorsal profile nearly straight; head pointed. Height 3.4 to 4; head somewhat more or less than thrice in length. Eye 3.2 to 3.7 in head, its diameter nearly equal to or greater than snout, 1.4 to 1.7 in postorbital part of head and 1 to 1.4 in interorbital space, which is flat and goes 2.7 to more than thrice in length of head. Maxillary extending to vertical through between nostrils or somewhat farther. Origin of dorsal conspicuously nearer to head than to base of caudal, opposite to 15th or 16th lateral scale and separated by 25 to 26 praedorsal scales from snout. The produced middle rays of dorsal nearly reaching caudal. Anal with a basal sheath of one (or two) irregular series of scales, its penultimate rays in old specimens strongly produced, reaching near end of caudal, the middle rays of which are prolonged. Pectorals about equal to head without snout. Height of caudal peduncle at base of caudal about twice in length of head. Brown, ventrally lighter. A dark longitudinal band from snout, through eye running above pectoral to caudal, a lower band beginning on head and running below pectoral to caudal; both unite in a round blotch at base of caudal. A few black points on anal and caudal. Otherwise fins dusky. Length 82 mm. [Type in the British Museum seen by us].

Nom. indig.: Tempalo (Djambi).

Habitat: Sumatra (Djambi!, Sidjundjung!, Taluk!, Gunung Sahilan!); Borneo (Sarawak!).

In rivers and brooks.

10. **Betta fasciata** Regan.

Betta fasciata Tate Regan, Proc. Zool. Soc. London 1909, p. 782.

D. I. 9—11; A. II. 28—30; P. 13; V. I. 5; L.l. 34—36; L.tr. $10^1/_2$.

Rostro-dorsal profile straight from dorsal to nape, from there to snout slightly declivous. Height 3.5—4.2; head 3.6—4.5 in length. Eye 3—4 in head, conspicuously longer than snout, 1.6 to twice in postorbital part of head and less than $1^1/_2$ times in convex interorbital space, which goes 2.6—3 times in length of head. Maxillary extending somewhat before or behind vertical through posterior nostril. Origin of dorsal nearer to caudal than to head, opposite to 18th or 19th lateral scale and separated by 28—30 praedorsal scales from snout. Fifth to 7th dorsal ray produced, reaching caudal or on it. Anal with a low sheath of one series of scales at its base; its 2 or 3 prepenultimate rays produced, even to last third of caudal. Caudal large, spoon-shaped, its central rays produced. Pectorals round, rather large, not much shorter than head. Height of caudal peduncle at base of caudal about 1.3 in length of head, much longer than its postorbital part. Lighter or darker brown, with about 6, more or less distinct, often faint, darker crossbars. Fins dusky, dorsal and caudal, at least its upper part with dark spots between rays; ventrals and anal blackish. Length 100 mm.

Habitat: Sumatra (Deli, Djambi!).

In freshwater.

11. **Betta bellica** Sauv.

Betta bellica Sauvage, Bull. Soc. Zool. de France IX. 1884, p. 217.
Betta bellica Tate Regan, Proc. Zool. Soc. London 1909, p. 779.

D. 1.10; A. 2.30—32 [1]); L.l. 35; L.tr. $9^1/_2$.

Rostro-dorsal profile slightly convex, more so in its anterior part. Height 4.2, head 3.4 in length. Eye 3.1 in head, its diameter conspicuously longer than snout, 1.7 in postorbital part of head and nearly equal to interorbital space, which is nearly $^1/_3$ of the length of the head. Maxillary ending not far from frontborder of eye. Origin of dorsal nearer to caudal than to head, separated by about 30 scales from snout and opposite to 19th or 20th lateral scale. Anal with a basal sheath of one regular row of scales. Pectorals about equal to head without snout. Height of caudal peduncle at base of caudal

1) According to SAUVAGE's description the anal has 37 rays but this must be a misprint, as his figure shows only 34 rays and the author says: "les 30 et 31e rayons de l'anale prolongés en filaments". In his figure follow 3 rays behind the two prolonged rays (the 30th and the 31st), thus in total 34 rays.

1.8 in head and equal to its postorbital part. Colour faded, uniform brown. Fins uniform. Length 50 mm.

Habitat: Pérak.

Note. We found in the collection of BLEEKER in the Leiden Museum in a bottle containing numerous specimens of *Betta* and named by BLEEKER *B. picta* the above described species. We are not sure that it is really *B. bellica* Sauv. as its description by SAUVAGE is very short and the accompanying figure probably not very good, but our specimen comes nearest to this species.

Doubtful species.

Betta pugnax (Cant.).

Macropodus pugnax Cantor, Cat. Malayan Fishes, Journ. Asiat. Soc. Bengal vol. XVIII. 1850, p. 1066.

This species is mentioned by the following authors from different localities in the Archipelago; by VON MARTENS [1]) (Borneo: Seminis); KÁROLI [2]) (Borneo: Palandok, Matang); BOULENGER [3]) (Sumatra: Deli); VAILLANT [4]) (Borneo: rivers Kapuas, Knapei, Sebruang, Mahakam); VOLZ [5]) (Sumatra: Palembang, Benakat, Lahat, rivers Mahé, Kwantan, Si Russi and at Indragiri, Tandjung Butus and Upper and Lower Langkat); FOWLER [6]) (Borneo: Baram river).

All the quoted authors give no description and as their publications appeared before the valuable revision of the genus *Betta* by TATE REGAN, who mentions as habitat for *B. pugnax* only Pinang, it is impossible to make out what species is meant by the quoted authors. PERUGIA [7]) gives a very short description of specimens found in Sumatra and named by him *B. pugnax*, but these specimens probably belong to *B. picta* (C.V.). Also the description of STEINDACHNER [8]) of specimens, which he

1) v. MARTENS, Preuss. Exp. nach Ost-Asien, 1876, p. 209.

2) KÁROLI, Termeszetrajzi füzetek V. 1882, p. 26.

3) BOULENGER, Proc. Zool. Soc. London 1890, p. 38.

4) VAILLANT, Nouv. Arch. Mus. Hist. Nat. (4) V. 1893, p. 103; Notes Leyden Mus. XXIV. 1902, p. 32.

5) VOLZ, Zool. Jahrb. Abt. Syst. XIX. 1903, p. 373; Revue Suisse Zool. XII. 1904, p. 459.

6) FOWLER, Proc. Acad. Nat. Sci. Philad. (2) LVII. 1905, p. 504.

7) PERUGIA, Ann. Mus. Civ. Genova (2) vol. XIII. 1893, p. 243.

8) STEINDACHNER, Abh. Senckenb. Naturforsch. Gesellsch. XXV. 1901, p. 434.

names *B. pugnax* from the Baram river in Borneo and of Ternate (a locality which is certainly erroneous), is too short to make out if they really belong to this species. We have never seen specimens of *Betta pugnax* from the Archipelago and have it therefore not included in this work.

11. Trichopodus Lacépède.

(Lacépède, Hist. nat. Poiss. III. 1802, p. 129).
Trichopus Cuvier & Valenciennes, Hist. Nat. Poissons. VII. 1831, p. 388.

Strongly compressed, oblong. Mouth somewhat protractile, very small, its cleft very oblique but horizontal when upper jaw is protruded. Lower jaw prominent; jaws with bands of minute fixed teeth, some larger ones in outer series. Praeorbital serrated. Scales ciliate, of moderate size, irregularly and obliquely arranged. Lateral line complete, tubular, more or less curved and irregular. Dorsal short, originating before or behind end of

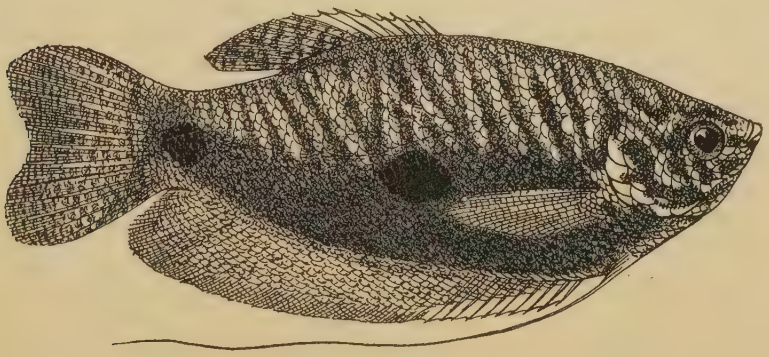

Fig. 93. *Trichopodus trichopterus* (Pall.) n. s.

spinous anal, with 3—8 increasing spines and 8—11 rays, ending far distant from caudal. Anal beginning about below base of pectorals, with 9—14 spines and 25—39 mostly unbranched rays, ending at base of caudal and covered by a sheath of scales, except their broad outer border. Caudal broad, more or less emarginate. Pectorals more or less pointed. Before their base originate the ventrals with the first ray transformed in a long, simple filament, to which are adnate a vestigal spine and 2 or 3 rudimentary rays. Operculum entire, prae-, sub- and interoperculum denticulate.

Distribution: Islands of the Archipelago situated between

Sumatra, Bali and Borneo; Pinang; Malay Peninsula; Siam and Cochin China.

In rivers, brooks, ponds and lakes.

Key to the indo-australian species of Trichopodus.

1. Origin of dorsal above soft anal. Anal X—XI (XII) 33—38. Eye twice or more in postorbital part of head. *Tr. trichopterus* p. 366.
2. Origin of dorsal above end of spinous dorsal. Anal XII—XIV 25—30. Eye much less than twice in postorbital part of head . . . . . *Tr. leeri* p. 367.

1. Trichopodus trichopterus (Pall.) [Fig. 93, p. 365].

Labrus trichopterus Pallas, Spicilegia Zool. VIII. 1777, p. 45.
Labrus trichopterus Linné, Syst. nat. edit. XIIIa (Gmelin) 1789, p. 1286.
Labrus trichopterus Bloch, Ausländ. Fische, VI. 1792, p. 23.
Trichogaster trichopterus Bloch, Schneider, Syst. ichth. 1801, p. 165.
Trichopodus trichopterus Lacépède, Hist. nat. Poiss. III. 1802, p. 125 & 129.
Trichopus trichopterus Cuvier & Valenciennes, Hist. nat. Poiss. VII. 1831, p. 290.
Trichopus sepat Bleeker, Nat. & Geneesk. Arch. Ned. Indië II. 1845, p. 520.
Trichopus trichopterus Bleeker, Verh. Bat. Genootsch. XXIII. 1850, Vissch. doolhofv. Kieuw. p. 10. — Atl. ichth. IX. 1877, tab. 395, Osphrom. tab. 1, fig. 4.
Trichopodus trichopterus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1071.
Osphromenus trichopterus Günther, Cat. Brit. Mus. III. 1859—1861, p. 384.
Osphromenus siamensis ibid. p. 385.
Trichopodus trichopterus Bleeker, Verh. Akad. Amsterdam XIX. 1879, Mém. Poiss. pharyng. labyrinth. p. 21 (p. p.).
Trichopus siamensis Sauvage, Nouv. Arch. Mus. (2) IV. 1881, p. 166.
Trichopodus trichopterus Tate Regan, Proc. Zool. Soc. London, 1909, p. 783.

D. VI—VIII. 8—9 (10); A. X—XI (XII). 33—38; P. 9—10; V. (I). 3—4; L.l. 30—40; sq. lat. 40—50; L.tr. 20—25 [1]).

Height in adult specimens 2.3—2.5, 3 or more in length with caudal. Head more or less acute, 3.2—3.4, 4.3—4.5 in length with caudal; rostro-frontal line concave or nearly straight. Diameter of eye more or less than $4^1/_2$ times in head, equal to or longer than snout, twice or more than twice in postorbital part of head. Colour very variable; in preserved specimens olivaceous above, lighter on flanks and below, or brownish,

1) The dorsal and anal are liable to considerable individual variation; among a large number of specimens we found f.i. the following combinations: D. VI. 7, A. XI. 34; D. VI. 8, A. X. 33; D. VII. 8, A. X. 36; D. VII. 9, A. X. 38; D. VIII. 8, A. X. 37; D. VIII. 9, A. X. 36. Only once D. VII. 10, but never less than 33 rays in the anal and never XII anal spines as recorded by Regan.

or head and upper half of body olivaceous or silvery with 15—20 irregular, oblique, partly confluent crossbands, which may be broken up into spots; lower half brownish. A round black spot on the middle of the side and an other at the base of the caudal, sometimes united by a blackish band from eye to caudal; soft dorsal and caudal, and sometimes also soft anal with alternating light spots, sometimes forming reticulations. Length 112 mm.

Nom. indig.: Sappe (Malay Sumatra), Sĕpat (Djambi, Palembang, Balikpapan, Java).

Habitat: Singapore; Sumatra (Palembang, Bagan Api Api!, Muara Enim, Ringat!, Taluk!, river Kwantan, Gunung Sahilan!, Sungei Mahé, Deli, Serdang!, Djambi!, Upper and Lower Langkat, Benkulen, Pagar Alam!, Padang, Ulakan, Solok!, Singkarah!, Priaman, Lahat, Padang Pandjang, Manindjau!, Fort de Kock!, Pajakombo!, Telok betong); Banka; Java (Buitenzorg!, Batavia!, Bandung!, Garut!, Tjipanas!, Palabuan, Lebak, Mount Gedeh, Tjiandjur, Ngawi, Gombong, river Brantas); Madura; Bali; Borneo (Sinkawang, Montrado, Kapuas: Lake Danau Sriang, Pontianak, Sebruang, river Kahajan, Bandjermassin, Pengaron, Mandhor, Balikpapan!). — Pinang, Malay Peninsula, Cochin China, Cambodja, Siam, Bengalen.

2. Trichopodus leeri (Blkr.)

Trichopodus trichopterus Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1071 (p. p.).
Trichopus Leerii Bleeker, Nat. Tijdschr. Ned. Indië III. 1852, p. 577.
Osphromenus trichopterus var. *γ. leerii* Günther, Cat. Brit. Mus. III. 1861, p. 384.
Trichopodus trichopterus Bleeker, Verh. Akad. Amsterdam XIX. Mém. Poiss. Pharyng. Labyrinth. 1879, p. 21 (p. p.).
Trichopodus leeri Tate Regan, Proc. Zool. Soc. London, 1909, p. 783.

D. V—VII. 8—10; A. XII—XIV. 25—30; P. 9; V. (I). 3—4; L.l. 30—37; Sq. lat. 44—50; L.tr. 20.

Height about 2.4 in length, 3.2—3.3 in length with caudal. Head acute, 3.1—3.4 in length, about 4.4 in length with caudal. Rostro-frontal line concave or nearly straight. Diameter of eye 3.4—3.8 in head, much less than twice (1.4) in postorbital part of head. Origin of dorsal opposite to end of spinous anal, to about 10th or 11th spine. Body and vertical fins with pale greenish spots enclosed in a reddish-brown network; a black longitudinal band from snout through eye, ending in a spot at the base of the caudal. Length 110 mm.

Habitat: Sumatra (Telok Betong, Palembang, Djambi!, Gunung Sahilan!, Lower Langkat, Deli); Borneo (Bandjermassin [river Barito], Sintang [river Kapuas]). — Siam (BLEEKER), Malay Peninsula.

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2. Fam. LUCIOCEPHALIDAE.

Elongate, subcylindrical, posteriorly somewhat compressed. Head not much shorter than trunk. Snout produced. Upper jaw much shorter than projecting mandible, bordered by intermaxillaries, which are strongly protractile and composed of an inner or anterior horizontal part and an outer or posterior part which is provided with an ample membranaceous fold and bent upward along snout when mouth is closed. When mouth is opened both parts are protruded so that the upper jaw is the longer and the gape rather wide. Jaws with small, conical, fixed teeth; vomer anteriorly rough by minute teeth. A short dorsal opposite to posterior half of anal. Anal with a deep notch, beginning at some distance behind vent. Caudal rounded. Pectorals short, rounded; below their base the ventrals with a weak spine and five rays, the first of which has at its outside a long articulated filament. Scales cycloid on head, ctenoid on trunk, moderate, regularly arranged, lateral line indicated on some scales by shallow impressions or abortive tubular lateral organs. Opercular bones entire, scaly, as also the large praeorbital, the rounded border of which is finely serrated. Gillopenings very wide, reaching to below eye, the naked gillmembranes not being united. Five branchiostegals. No pseudobranchiae. Four complete gills. No air-bladder. Suprabranchial organ well developed [1]).

1. Luciocephalus Bleeker.

(BLEEKER, Nat. Tijdschr. Ned. Indië, I. 1851, p. 274).
Diplopterus Gray, Illustr. of Indian Zoology I. 1830—1832, tab. 87, fig. 1 (figure only, no description; name preoccupied).

For characters of the single genus see those of the family. Distribution: that of the single species known.

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1) First described by BLEEKER (Nat. Tijdschr. Ned. Indië XX. 1859—1860, p. 395).

1. **Luciocephalus pulcher** (Gray) [Fig. 94, p. 369].

Diplopterus pulcher Gray, Illustrat. Indian Zoology I. 1830—1832, tab. 87, fig. 1 (figure only).

Luciocephalus pulcher Bleeker, Nat. Tijdschr. Ned. Indië I. 1851, p. 274. — Ibid. III. 1852, p. 99.

Luciocephalus pulcher Bleeker, Verh. Bat. Gen. XXIV. 1852, Bijdr. Snoekacht. Visschen, p. 24.

Luciocephalus pulcher Bleeker, Verh. Akad. Amsterdam XIX. 1879, Poiss. pharyng. labyrinth. p. 29. — Atl. ichth. IX. 1877, Tab. 396, Osphrom. tab. 2, fig. 1.

Luciocephalus pulcher Vaillant, Nouv. Arch. Mus. Hist. Nat. (4) V. 1893, p. 104.

D. 9—11; A. 18—19; P. 15—16; V. 1.5; L.l. 40—42; L.tr. 12—13.

Proportions changing with age, in large specimens height more than 5.5 times, head slightly more than twice in length without caudal. Eye nearly in the middle of head, about 7 times in its length, less than interorbital space, more than 2.5 in postorbital part of head and thrice in length of snout. Median fins without scales. Caudal obtusely and somewhat asymmetrically

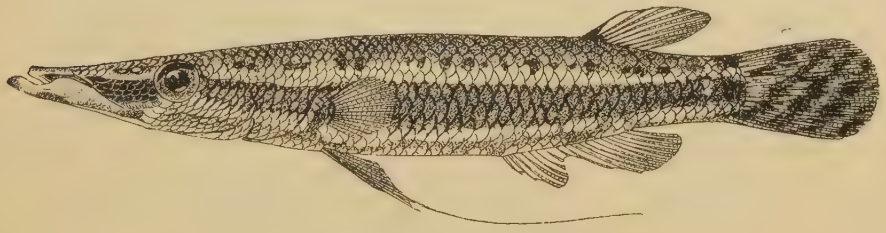

Fig. 94. *Luciocephalus pulcher* (Gray). × 3/4.

rounded. Pectorals small, somewhat longer than half length of postorbital part of head. Ventral filaments nearly reaching to end of anal. Colour very variable, usually back and dorsal surface of head brown, otherwise yellowish; a broad brown band from snout to caudal, above and along it often one or more longitudinal series of dark brown blotches. Caudal with blackish oblique bands and a basal blotch. Length 180 mm.

Nom. indig. Tumbu Ramer (Djambi); Djulung djulung nansuli (Laut Tador), Bruson, Tom-brudjon (Danau Sriang).

Habitat: Singapore; Sumatra (Lahat, Palembang, Musi ilir, Benakat, Sungi Surikaka, Sungi Mahe, Indragiri, Laut Tador, Taluk!, Gunung Sahilan!, Djambi!,); Banka; Biliton; Borneo (Baram, Sarawak, Bankayan, mouth and upper course river Kapuas: Danau Sriang, Sintang, Sebruang, Kahajan, Bandjermassin); Pulu Matjan. — Malay Peninsula.

Order MICROCYPRINI Tate Regan.

Airbladder without an open duct. Scales present, cycloid. No lateral line. Parietals, when present, separated by the supra-occipital, which is in contact with the frontals. Orbitosphenoid wanting. Mesocoracoid wanting. Opercular bones normally developed. Lower jaw with or without a sesamoid articular. Fins without spines. Pectorals inserted high up or lower down. Pectoral arch suspended from the skull. Ventrals abdominal, 6 or 7-rayed, not attached to cleithra, sometimes wanting. Dorsal fin placed far back, above anal. Anus posterior or anterior. Anterior vertebrae not modified. Mouth generally small, bordered by intermaxillaries only. Lower pharyngeals separate, or, if united, with the median suture persistent. Branchiostegals 4—7.

Key to the indo-australian families of Microcyprini.

1. Ventrals present [1]). Anus posterior, near anal.
   a. Snout short, mouth small or moderate, intermaxillaries not coalesced with maxillaries. Second, third and fourth upper pharyngeals dentigerous. Scales rather large. L.l. in indo-australian species 29—34. *Cyprinodontidae* p. 371.
   b. Snout longer, mouth large, semicircular or horse-shoe-shaped. Intermaxillaries firmly united to maxillaries or coalesced with them. Third and fourth upper pharyngeals dentigerous. Scales small. L.l. 70—80 . . . . . *Adrianichthyidae* p. 376.
2. Ventrals wanting. Anus anterior, in females between pectorals, opening into a fleshy appendage below head in males . . . . . *Phallostethidae* p. 381.

1) In indo-australian species.

1. Fam. Cyprinodontidae.

Elongate, more or less strongly compressed. Head depressed, flattened above as well as anterior part of back. Scales rather large. Head scaly, at least above. Mouth small or moderate, protractile or not. Maxillaries slender, not coalesced with intermaxillaries. Pointed or conical teeth in the jaws and sometimes on the vomer. Mesopterygoid wanting. Pectorals inserted high up or not. Ventrals with 6—7 rays. Caudal acuminate, rounded, truncate, emarginate or forked. Second, third and fourth upper pharyngeals dentigerous [1]). Gillmembranes free or more or less connected, free from isthmus. Branchiostegals 4—6.

Generally small fishes, living in sea near the shore and in brackish or freshwater of southern parts of North America, in South America, Southern Europe, Africa and Southern Asia.

Key to the indo-australian genera of Cyprinodontidae.

1. Mouth small, upper jaw not protractile. No teeth on vomer. Gillmembranes broadly united. Pectorals situated high up. *Aplocheilus* p. 371.
2. Mouth moderate, with a distinct bent downwards near corner of mouth. Upper jaw protractile. Teeth on vomer. Gillmembranes free from each other. Pectorals low, situated below middle of height . . . . . *Panchax* p. 374.

1. Aplocheilus Mc Clelland.

(Mc Clelland, Ind. Cyprin. As. Res. XIX. 1839, p. 426.)
Haplochilus auctt. p. p., *Oryzias* Jordan & Snyder.

Elongate, compressed. Head and anterior part of back flat-

Fig. 95. *Aplocheilus celebensis* M. Web. n.s.; the left figure shows the head from above: *i* intermaxillare.

tened above. Mouth small, horizontal. Upper jaw not protrac-

1) According to Tate Regan, Ann. Mag. Nat. Hist. (8) VII. 1911, p. 321.

tile. A single series of teeth in the jaws or this series followed behind by a few more series of smaller teeth. No teeth on vomer. Head scaly above and on operculum. Scales rather large. Dorsal short, its origin behind that of anal. Pectorals situated high up. Ventrals far from pectorals. Caudal rounded. Five branchiostegals. Gillmembranes broadly united, free from isthmus. No pseudobranchiae.

Distribution: Fresh and brackish water of Africa, Asia, Japan, indo-australian Archipelago to the east as far as Celebes and Timor.

These small fishes are mosquito-distroyers.

Key to the indo-australian species of Aplocheilus.

1. D. 7; A. 21—23. L. tr. 10 . . . . . *A. javanicus* p. 372.
2. D. 7—9; A 17—21. L. tr. 14.
   a. Origin of anal midway between base of caudal and pupil. Origin of ventrals midway between snout and end of anal . . . . . *A. celebensis* p. 373.
   b. Origin of anal nearer to base of caudal than to hindborder of eye. Origin of ventrals nearer to end of anal than to snout . . . . . *A. timorensis* p. 373.

1. Aplocheilus javanicus Blkr.

Aplocheilus javanicus Bleeker, Nat. Tijdschr. Ned. Indië VII. 1854, p. 323. — Ichth. Arch. Ind. Prodr. II. Cyprini 1860, p. 490. — Atl. ichth. III. 1863, p. 141.
Haplochilus javanicus Günther, Cat. Brit. Mus. VI. 1866, p. 311.
Haplochilus javanicus v. *trilineata* Popta, Notes Leyden Museum XXXIV. 1911, p. 13.
Aplocheilus javanicus Max Weber, Siboga-Exp. Fische, 1913, p. 91.

D. 7; A. 21—23; P. 1.10—11; V. 6; L.l. 29—30; L.tr. 10.

Compressed, head and anterior part of back flattened. Height 3.5—3.7, 4—4.5 in length with caudal. Head about 3.7, about 4.5 in length with caudal. Eye about 2.5, longer than snout, scarcely longer than postorbital part of head and about equal to interorbital space. Cleft of mouth small, horizontal. Corner of mouth more than half length of snout from frontborder of eye. Origin of dorsal separated by 22 or 23 scales from large scales on occiput; above last third of anal. Origin of anal midway between base of caudal and pupil. Pectorals as long as head. Ventrals midway between snout and end of anal or somewhat nearer to snout. Caudal rounded. Colour yellow, belly

more or less silvery. Upper surface of head darker. Back dusky. A fine dark lateral line, a second one above the base of the anal, uniting with that of the other side behind anal. Generally a median dorsal line. Fins hyaline. Length 35 mm.

Nom. indig.: Impun (Sundan.), Lundjar (Javanese).

Habitat: Singapore; Java (Perdana, Tjandjur, Nusa Kembangan!); Lombok!. — Malacca, China (KÁROLI JANOS).

In fresh and brackish water.

2. Aplocheilus celebensis M. Web. [Fig. 95, p. 371].

Haplochilus celebensis Max Weber, Zool. Ergebn. einer Reise in Niederl. Ost-Indien III. 1894, p. 426.

Haplochilus celebensis Boulenger, Proc. Zool. Soc. 1897, p. 429.

D. 7—9 (generally 9); A. 17—21; P. 1.10—11; V. 6; L.l. 30—32; L.tr. 14.

Compressed, upper part of head and anterior part of back flattened. Height 3.8, 4.5 in length with caudal. Head about 4.2, 5.2 in length with caudal. Eye 2.3, much longer than snout, somewhat less than postorbital part of head and interorbital space. Cleft of mouth small, horizontal. Corner of mouth much nearer to end of snout than to frontborder of eye. Origin of dorsal separated by 23 scales from large scales on occiput; above last third of anal. Origin of anal midway between base of caudal and pupil. Pectorals shorter than head, but longer than head without snout. Origin of ventrals midway between snout and end of anal. Caudal rounded. Yellow, belly more or less silvery. A very narrow dark lateral line. Generally a similar line above base of anal, uniting with that of the other side behind base of anal. A median dorsal line sometimes present. Length 38 mm.

Habitat: Celebes (Makassar!, Maros!, Teteadji!).

Fresh water.

3. Aplocheilus timorensis n.sp.

Aplocheilus celebensis Max Weber & de Beaufort, Versl. Vergad. Wis- en Natuurk. Afd. Kon. Akad. Amsterdam 1912, p. 135 (nec M. Weber).

D. 9; A. 17—19; P. 1.10—11; V. 6; L.l. 31—34; L.tr. 14.

Compressed, head flattened above. Height 3.7—3.8, 4.6—4.7 in length with caudal. Head 3.3—3.5, 4.1—4.3 in length with caudal. Eye about 3 in head, scarcely longer than snout and scarcely shorter than postorbital part of head, less than inter-

orbital space. Cleft of mouth small, horizontal. Corner of mouth much nearer to end of snout than to frontborder of eye. Origin of dorsal separated by about 26 scales from large scales on occiput; above or somewhat behind the middle of the anal. Origin of anal nearer to base of caudal than to hindborder of eye. Origin of ventrals nearer to end of anal than to snout. Pectorals shorter than head? (damaged in all specimens examined). Caudal rounded. Brownish, belly darkish (peritoneum shining through). A fine dark lateral line ending in a more or less conspicuous black blotch at end of caudal. A similar line runs above base of anal and unites with that of the other side behind anal. A median dorsal line present in young specimens. A row of darkish blotches on middle of sides of trunk generally present. Length 37 mm.

Habitat: Mid-Timor (Mota Talau!).

Fresh water.

2. **Panchax** Cuvier & Valenciennes.

(Cuvier & Valenciennes, Hist. Nat. Poissons XVIII. 1846, p. 380.)
Haplochilus auctt. p.p.

Elongate, compressed. Head and anterior part of back flattened above. Mouth moderate, with a sharp bent downwards near corner of mouth. Upper jaw protractile. Bands of teeth in the jaws. Teeth on vomer. Head scaly above and on operculum. Scales rather large. Dorsal short, its origin behind that of anal. Pectorals originating in lower half of body. Ventrals far from pectorals. Caudal rounded. Five branchiostegals. Gill-membranes free from each other. Pseudobranchiae present.

Distribution: Fresh and brackish water of Africa, Asia, Sumatra, Java and Borneo.

1. **Panchax panchax** (H.B.) [Fig. 96, 97, p. 375].

Esox panchax Hamilton Buchanan, Fishes Ganges 1822, p. 211 & p. 380.
Panchax Buchanani Cuvier & Valenciennes. Hist. Nat. Poissons XVIII. 1846, p. 383.
Panchax Kuhlii Cuvier & Valenciennes, ibid. p. 384.
Panchax panchax Cantor, Journ. Asiat. Soc. Bengal XVIII. 1850, p. 1234.
Panchax melanotopterus Bleeker, Verh. Bat. Gen. XXIII. 1850, Bijdr. kennis ichthyol. fauna Midden- en Oost-Java, p. 22.
Panchax Buchanani Bleeker, ibid. XXV. 1853, Nalez. Ichthyol. fauna Bengalen, p. 144.
Panchax Buchanani Bleeker, Ichth. Arch. Ind. Prodr. II. Cyprini 1860, p. 488. — Atl. ichth. III. 1863, p. 141.
Haplochilus panchax Günther, Cat. Brit. Mus. VI. 1866, p. 311.

Haplochilus panchax Day, Fishes of India 4°. 1878—1888, p. 523.
Panchax panchax Chaudhuri, Mem. Ind. Mus. V. 1916, p. 451.

D. 7—8; A. 15—16; P. 14; V. 6; L.l. 31; L.tr. $8^1/_2$—9.

Compressed behind, head depressed, flattened above as well as the anterior part of back. Height 4.5—5.5, 5.5—7 in length with caudal. Head 3—3.5, 3.8—4.5 in length with caudal. Eye about 3.5, somewhat shorter than snout, which is equal to postorbital part of head and to interorbital space. Cleft of mouth not quite extending to vertical through frontborder of eye. Lower jaw slightly prominent. Small pointed teeth in several rows in the jaws, smaller ones in an irregular transverse series on head of vomer. Origin of dorsal above 13th to last anal ray, separated by 24—26 scales from snout. Origin of ventrals scarcely nearer to tip of snout than to base of caudal. Pectorals as long as or somewhat longer than head without snout. Colour of alcohol specimens brownish, lighter below, each scale with a submarginal black border. A silvery shining spot on middle of occiput, just behind eye, not always visible in preserved specimens [1]). Dorsal with a black blotch at its base. Anal and caudal more or less spotted with blackish. Paired fins hyaline. Length over 55 mm.

Fig. 96. *Panchax panchax* (H.B.) × 5/4.

Fig. 97. *Panchax panchax* (H.B.). Head from above × $5^1/_2$; on occiput the silvery spot; *i* intermaxillare, *m* mandibula, *n* nostril.

Nom. indig.: Tjupang and Kapala tima (Malay, Batavia), Sisik malik (Sundan.), Wader peto (Javanese, Djocja).

Habitat: Singapore; Sumatra; Java (pond near Priok!, Batavia, Tandjong-Oost, Tjampea, Buitenzorg!, Gombong, Pand-

1) This spot occurs also in *Aplocheilus*. For its biological pecularities see: Miehe, Javanische Studien (Abhandl. d. Math. Phys. Kl. d. Kgl. Sächs. Gesellsch. d. Wissensch., Bd. XXXII, Nr. 4, 1911) and Über den Okzipitalfleck von *Haplochilus panchax* (Biol. Centralbl. Bd. XXXI. 1911, p. 732).

jallu, Djocja!, Surabaya, Pasuruan, Lesti, pond near Belombing!, Tjilatjap!); Borneo (Banjermassin, middle course of river Kapuas). — From Orissa, through the lower province of Bengal, Burma, Siam, Andaman Islands and Malacca.

In fresh and brackish water; living in sheltered and stagnant water and feeding also on insects and therefore a destroyer of mosquito-larvae [1]).

2. Fam. Adrianichthyidae.

Elongate, more or less strongly compressed. Head depressed,

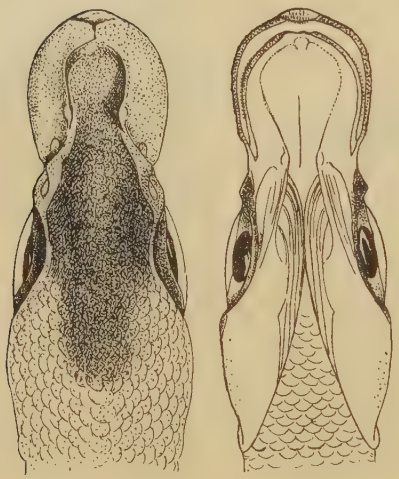

Fig. 98. *Adrianichthys kruyti* M. Web. From above and below × 3/4, to show the intermaxillaries coalesced with the maxillaries. The separate piece in front of the intermaxillaries is probably an artefact, caused by two symmetrical cracks.

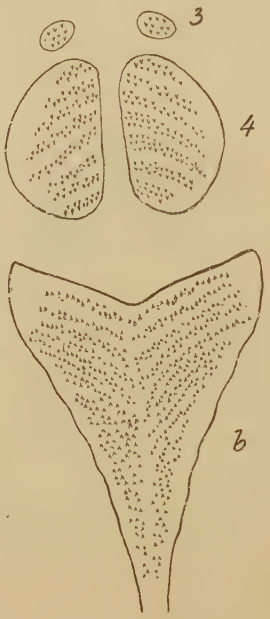

Fig. 99. *Adrianichthys kruyti* M. Web. × 5, *b*. Basibranchiale; 3, 4. Third and fourth Pharyngobranchiale.

flattened above, as well as anterior part of back. Scales small. Head scaly above and on opercles. Mouth large, horse-shoe-

1) N. H. Swellengrebel & I. M. H. Swellengrebel—de Graaf (Journ. tropical Medicine & Hygiene XXIII No. 7, 1920, p. 77). We are informed, that Dr. A. L. J. Sunier, head of the Government Laboratory for Marine Investigation at Batavia, will soon publish further studies about the larva-destroying qualities of *Panchax panchax*,

shaped. Intermaxillaries not protractile, firmly united even coalesced with maxillaries. Maxillaries articulating with a prominent knob at the anterior extremity of the palatines. No mesopterygoid. Pointed teeth in jaws. None on palate. Pectorals inserted rather high up. Ventrals with 6 or 7 rays. Caudal emarginate. Gillmembranes free from isthmus. No pseudobranchiae. Third and fourth upper pharyngeals dentigerous. Gillmembranes free from isthmus and from each other. Branchiostegals 5—7.

Distribution: Lakes of Celebes.

Freshwater.

Key to the genera of Adrianichthyidae.

1. Lower jaw slightly prominent. Intermaxillaries not coalesced with maxillaries. D. 11—13. V. 7 . . . . . *Xenopoecilus* p. 377.
2. Lower jaw totally included. Intermaxillaries coalesced with maxillaries. D. 17. V. 6 . . . . . *Adrianichthys* p. 379.

1. Xenopoecilus Tate Regan.

(Tate Regan, Ann. Mag. Nat. Hist. (8) VIII. 1911, p. 374).

Elongate, compressed. Head flattened above. Bones of skull, especially the dermal ones, thin and delicate. Mouth large, not protractile, horizontal with a bent downwards near corner of mouth, bordered above by the intermaxillaries, which bear villiform band of pointed teeth, similar to that in the lower jaw. Maxillaries behind intermaxillaries, not coalesced with

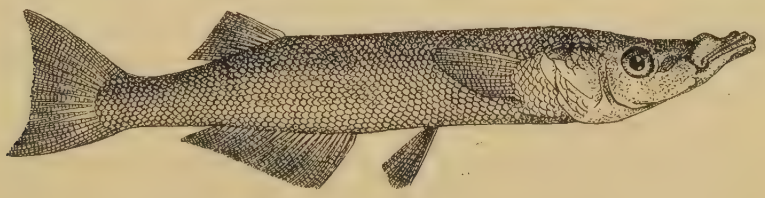

Fig. 100. *Xenopoecilus poptae* n. sp. × ½.

them, articulating with palatines by a knoblike articulation, which gives rise to a prominence on the dorsal side of the flat snout. No teeth on palate. Head scaly above and on opercles. Scales small, more than 70 in a lateral line, thin, cycloid with concentric lines. Dorsal rather short, with 11—13 rays, situated above anal, which is longer and the origin of which

is situated before that of dorsal. Pectorals rather high up. Ventrals abdominal, small in males, large in females, with 7 rays. Caudal more or less deeply emarginate. Gillmembranes free from isthmus, only united with each other at their rostral end. Six or seven branchiostegals. No pseudobranchiae. Gill-rakers small, knob-like or pointed. Third and fourth upper pharyngeals dentigerous, the teeth of the fourth in a large oval patch, those of the third in a small elongate one. Lower pharyngeals separate, triangular.

Distribution: Two species known from lakes in the interior of Celebes.

Key to the species of Xenopoecilus.

1. A. 21—23. Pectorals 1.5 in head. Origin of anal nearer to head than to base of caudal . . . . . *X. sarasinorum* p. 378.
2. A. 24—27. Pectorals 1.8—2.4 in head. Origin of anal midway between head and base of caudal . . . . . *X. poptae* p. 379.

1. Xenopoecilus sarasinorum (Popta).

Haplochilus sarasinorum Popta, Notes Leyden Museum XXV. 1904 (1905), p. 239.
Xenopoecilus sarasinorum Tate Regan, Ann. Mag. Nat. Hist (8) VIII. 1911, p. 374.

B. 6; D. 11—13; A. 21—23; P. 11—12; V. 7; L.l. 75; L.tr. 21.

Head depressed, flattened above, body and tail compressed. Dorsal profile nearly straight. Height 5.6—6.5, 6.7—7.7 in length with caudal. Head 3.2—3.3, 3.8—3.9 in length with caudal. Eye 3.3—3.7, 1.2 in snout, 1.4—1.6 in postorbital part of head and about equal to interorbital space. A narrow band of small, pointed, unequal teeth in the jaws. Cleft of mouth reaching to middle of snout. Dorsal above last half of anal. Origin of anal nearer to head than to base of caudal. Pectorals 1.5 in head. Ventrals 3.5—4 in head in males, 2 in head in females. Origin of ventrals somewhat nearer to base of caudal than to point of snout. Caudal deeply emarginate. Colour of alcohol specimens brownish yellow, upper part of head darker brown. Sides silvery, with a fine blackish longitudinal stripe. Dorsal dark brown, anal, caudal and pectorals brown. Ventrals hyaline. Length 69 mm. [After C. Popta, not seen by us].

Habitat: Celebes (Lake Lindu).

2. **Xenopoecilus poptae** n. sp. [1]) [Fig. 100, p. 377].

B. 7; D. 11—13; A. 24—27; P. 12—13; V. 7; L.l. circa 75; L.tr. circa 20.

Head depressed, flattened above, body and tail compressed. Dorsal profile straight. Height 4.4—6.5, 5.1—7.5 in length with caudal. Head 3—3.2, 3.4—3.6 in length with caudal. Eye 4—5.2, 1.6—2.5 in snout, 1.5—1.6 in postorbital part of head and 1.2—1.6 in interorbital space. Villiform band of pointed teeth in the jaws. Corner of mouth one eye-diameter before eye. Origin of dorsal somewhat before middle of anal. Origin of anal midway between head and base of caudal. In the males the dorsal and anal rays are much stronger and somewhat longer than in the females. Pectorals 1.8—2.4 in head. Ventrals 4—5 in head in males, about 2.3 in head in females. Base of ventrals midway between point of snout and base of caudal. Caudal slightly emarginate. Colour of alcohol specimens brownish above, darker on the head. Sides and belly silvery. Fins dusky. Length of 11 specimens examined 97.5—204 mm.

Habitat: Celebes (Lake Posso!).

Freshwater.

Note. Mr. A. C. KRUYT informs us, that this fish is caught by hooks in November, December and January, when great shoals of it are living in depths of 12 to 15 m. This is the season of propagation as the caught fishes immediately discharge their eggs. As soon as the eggs are extruded, the young fry is hatched and swims with the mother. In the period of spawning, the broken eggmembranes, rising to the surface, cover extensive stretches of it and are called by the Toradjas "momosonja".

2. Adrianichthys M. Weber.

(MAX WEBER, Bijdragen tot de Dierkunde, Amsterdam, 19de Afl. 1913, p. 204).

Elongate, compressed. Head flattened above. Mouth rather large, not protractile, horse-shoe-shaped, bordered above by the large intermaxillaries, which are coalesced with the maxillaries, the two forming one large bone in the form of a hoof, which articulates with the palatines by means of a knob-like

1) Named in honour of Miss Dr. C. POPTA, the indefatigable ichthyologist of the Leiden Museum.

articulation, prominent on the upper surface of the snout.[1])

Lower jaw totally included. Both jaws with a narrow villi-

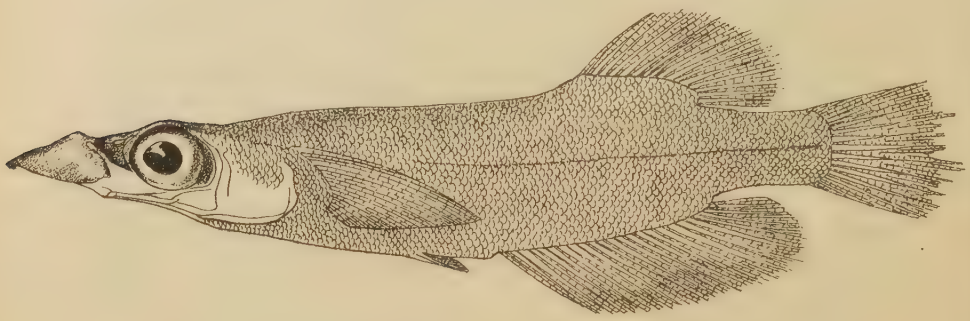

Fig. 101. *Adrianichthys kruyti* M. Web. n. s.

form band of small pointed teeth. No teeth on palate. Head scaly above and on opercles. Scales small, more than 70 in a lateral line, thin, cycloid. Dorsal rather long, with 17 rays, situated above last two thirds of long anal. Pectorals inserted in the middle of the height of the body. Ventrals abdominal, small in the only specimen known, with 6 rays. Caudal probably emarginate. Gillmembranes free from isthmus and from each other. Five branchiostegals. Pseudobranchiae hidden. Gillrakers small, knob-like. Third and fourth upper pharyngeals, dentigerous, the teeth of the fourth in a large oval patch, those of the third in a small rounded one. Lower pharyngeals (basibranchials) triangular, united, the suture being visible (Fig. 99).

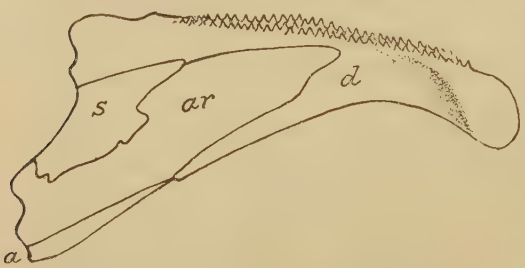

Fig. 102. *Adrianichthys kruyti* M. Web. Left mandible seen by horizontal orientation of the fish × 7. *a* angular, *ar* articular, *d* dental with teeth, *s* sesamoid articular.

Distribution: that of the single species known.

1) The arrangement of these parts of the upper jaw was only clear to us, after we had examined *Xenopoecilus*. This explains the different interpretation by one of us, when describing the genus. We believe now, that the bone described there (see fig. 98) as intermaxillary, is an artefact, caused by two symmetrical cracks in the real intermaxillaries.

1. **Adrianichthys kruyti** M. Web. [Figs. 98, 99, 101, 102, p. 376, 380].

Adrianichthys Kruyti M. Weber, Bijdragen Dierkunde 19de Afl. 1913, Amsterdam, p. 205.

B. 5; D. 17; A. 25; P. 16; V. 6; L.l. ca. 70—80.

Height a little more than 4.7, head 2.8. Snout more than twice in head. Eye 3.5, equal to postorbital part of head and somewhat more than concave interorbital space. Length of base of dorsal equal to head without snout. Base of anal equal to head without its postorbital part. Pectorals longer than head without snout. Ventrals not reaching anal, equal to half snout. Caudal probably emarginate. Colour in alcohol yellowish, upper part of head and body coffee-brown. Snout powdered with brown, as well as the fins. Length of single specimen known 110 mm.

Habitat: Celebes (Lake Posso!).

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3. Fam. PHALLOSTETHIDAE.

Elongate, compressed. Scales rather large. Mouth rather large, strongly oblique. Maxillaries not coalesced with intermaxillaries. Pectorals placed rather high. Ventrals wanting. Caudal emarginate. Anus anterior, in females between pectorals. In males there is a complicated fleshy appendage (priapium) below head and anterior part of body, on one of the sides of which

Fig. 103. *Neostethus lankesteri* Regan. ♂ about × 1/3.
Outline with the priapium: a fleshy appendage below the head and anterior part of body; at the outside of the priapium the curved, rodlike ctenactinium. After TATE REGAN.

(either right or left) the anus opens. The genital papilla opens on the opposite side. The priapium is supported by one or both cleithra and the first pair of ribs or one of them, these bones being modified. Moreover the priapium is provided with a complicated structure of bones, with special muscles. Of

these bones one or two curved rod-like ones (ctenactinium) are situated outside the priapium, at the aproctal side, and attached to it posteriorly. An other bone (toxactinium) in front of the priapium, may be present [1]).

Distribution: Two genera with three species are known from brackish water of Malacca and Singapore.

1. Neostethus Tate Regan.

(C. Tate Regan, Proc. Zool. Soc. London 1916, p. 2).

Elongate, strongly compressed. Head rather small. Mouth terminal, strongly oblique. One or two series of conical teeth in the jaws. Dorsal fin with 5 or 6 rays, above the end of the rather long anal, which has 13—16 rays. Pectorals placed rather high. Ventrals wanting, perhaps represented by a pair of papillae just behind the anus in the female. Caudal emarginate. Anus, genital aperture and urinary opening behind each other in the middle line below base of pectoral fins in the female; behind them the abdomen is compressed into an edge bearing a rayless fringe. In males the priapium is attached for the greater part of its length to the head and anterior part of body, only the posterior end being free. One or two ctenactinia present. No toxactinium. A glandular longitudinal groove along the upper part of the priapium, at its aproctal side and continued behind into an efferent groove. Seminal papilla opening into the glandular groove or into the efferent groove.

Distribution: Two species known, from the Malay Peninsula and Singapore.

Brackish water.

1. Neostethus lankesteri Regan [Fig. 103, p. 381].

Neostethus lankesteri Tate Regan, Proc. Zool. Soc. London 1916, p. 2.

D. 5—6; A. 15—16; P. 10—11; L.l. 34—36.

Height 4.7, 5.7 in length with caudal. Head 4.1, 5 in length with caudal. Eye 3. Origin of dorsal above last ray of anal. Pectorals somewhat less than head without snout. In the male

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1) For particulars of these extraordinary structures see Tate Regan, Proc. Zool. Soc. London 1916, p. 1.

the seminal papilla opens into the glandular groove. One ctenactinium present, slender, curved backwards and upwards, then forwards to below the eye, and, finally, downwards and across beneath the chin. Length 30 mm. [After TATE REGAN, not seen by us].

Habitat: Singapore, Malay Peninsula (Muar river).

Brackish water.

ALPHABETICAL INDEX

OF

VERNACULAR NAMES [1]).

Alu alu 222, 227.
Antori biru 190.
Badō 318.
Bale balana 236.
Baling 200.
Batje 318.
Bato 336.
Belana putih 251.
Belanak djumpul 245.
Belontja 339.
Betik 336.
Betok 336.
Biawan 340.
Boga 322.
Bolobo 157.
Bonti-bonti 281.
Bruson 369.
Budi 53, 59.
Buluari 213.
Bulu-bulu 213, 214.
Deluk 318.
Djulong-djulong 121, 125, 127, 128, 132, 134, 140, 148, 151, 152, 154, 156, 157, 158.
Djulung djulung nansuli 369.
ĕnai boe manâ 45.
Gabus 318, 322.
Gabus tjina 327.
Gabus tobang 329.
Gadeh 251, 253.
Gadjah menong 112.
Gĕreh 245.
Geteh-geteh 336.
Goru 245.
Gorua 251, 253.
Gurami 344.
Halu-halu 225.
Haruan 318.
Harvan 336.
Heedjo gaddo 322.
Hoseng 336.
Idung lamak 204.
Ikan Belanak 253.
Ikan kadjangan 170.
Ikan kali 344.
Ikan kuda 112.
Ikan terbang 190.
Ikan toman 329.
Impun 373.
Kadjang 125, 127.
Kalui 344.
Kaluna 276.

1) As in Java the three languages: javanese, sundanese and malay are spoken, we have accordingly placed behind the indigenous names (Malay.), (Sundan.) or (Javan.). In naming a fish the malay people use as a rule "ikan" = fish before the special name. In most cases we have omitted "ikan".

Kapala tima 375.
Katjangan 121.
Katoprak 339.
Kelatal 360.
Kelatau 360.
Kesumbang 200, 204.
Kilih buaja 45.
Kurau hitam 206.
Kurau putih 200.
Kuru 199, 200, 204, 206, 208, 211, 212, 213.
Kuru-laut 206.
Kusa 336.
Kusang 336.
Kuto 318, 322.
Kuto bengo 322.
Lalaut 200.
Langsar 125, 222.
Laos 213.
Latjeh 200.
Leres 222.
Lewut 356.
Lontjong 121, 127.
Lumbungan 276.
Lundjar 373.
Luwin-luwin 190.
Matjè 356.
Mauru 156.
Mowaru 157.
Mudju mudju 327.
Mulut tikus 210.
Ongwaru 158.
Opudi 280.
Pangkilan 138.
Papuju hidju 336.
Penjolang 134.
Pettek 351.
Pujo-Pujo 336.
Puju 336.
Puput 154.
Rajong 318.
Rapang 245.
Rodja rodja 152.
Roja 157.
Sakku 127, 132.
Saku 127.
Salintja 339.
Sambal 204.
Sapil 340.
Sappe 367.
Selangin 200.
Senuk 222, 224, 225, 227.
Sĕpat 367.
Sepat-anatih 351.
Se Punkat 318.
Serangin 200.
Séu 309.
Sili 45.
Silowang 127.
Sisik malik 375.
Sogoprono 93.
Suma lahat 210.
Suro 199.
Tabakang 340.
Tambakan 339, 340.
Tangkuloh 225.
Tempalo 358, 362.
Tendrah 121, 127.
Tikus tikus 200.
Tjakalang 128.
Tjampala 360.
Tjaratja 140.
Tjupang 351, 375.
Toda palpia 125.
Tom-brudjon 369.
Tratjas 157.
Tuda laut 121.
Tumbu Ramer 369.
Tunel 222, 225.
Tuvung tuvung 45.
Umpua 200.
Usang 356.
Useng 336.
Wader peto 375.

ALPHABETICAL INDEX

OF

GENERA AND SPECIES.

abdominalis, Hippocampus 107, 108.
abendanoni, Telmatherina 279, 281.
Acanthognathus 34, 37, 41.
Acanthognathus dactyliophorus 42.
Acentrachme 21.
Acentrachme pachyacanthus 22.
Acentrachme scutata 22.
acus, Syngnathus 79, 88.
Adrianichthyidae 370, 376, 377.
Adrianichthys 377, 379.
Adrianichthys kruyti 376, 380, 381.
adustus, Mugil 249.
Aeoliscus 18, 19, 20.
Aeoliscus strigatus 19, 20.
Aeschrichthys 260.
Aeschrichthys goldiei 262.
affinis, Exocoetus 181.
affinis, Halosauropsis 4, 5, 6.
affinis, Halosaurus 5.
affinis, Ophiocephalus 330.
affinis, Rhombatractus 304.
agam, Sphyraena 224.
agonasi, Polydactylus 203.
agonasi, Polynemus 203.
Agonostoma 260.
Agonostoma oxyrhynchum 263.
Agonostoma plicatile 261.
Agonostomus 260, 265.
Agonostomus bryanti 265.
Agonostomus monticola 265.
Aida 288.
akarensis, Betta 354, 357.
alcocki, Mugil 243.
Aldrovandia 4.
altipennis, Cypsilurus 180, 184, 185.
altipennis, Exocoetus 184.
altipinnis, Cypsilurus 184.
altipinnis, Exocoetus 184.
altipinnis, Sphyraena 220, 222.
amblyurus, Hemirhamphus 165.
amblyurus, Zenarchopterus 165.
Amphiprion scansor 334.
Amphisile 20, 21.
Amphisile cristata 23.
Amphisile Finschii 22.
Amphisile macrophthalma 22.
Amphisile scutata 20, 22.
Amphisile strigata 20.
Amphiprion testudineus 334.
Anabantidae 331, 332.
Anabantoidei 312, 330, 331.
Anabas 330, 331, 332, 333.
Anabas elongatus 334.
Anabas macrocephalus 334.
Anabas microcephalus 334.
Anabas oligolepis 334, 336.
Anabas scandens 334.
Anabas spinosus 334.
Anabas testudineus 333, 334.
Anabas variegatus 334.
anabatoides, Betta 353, 354, 357.
anastomella, Mastacembelus 124.

Andersonii, Syngnathus 76.
anguilliformis, Halosaurus 5.
Anisocentrus rubrostriatus 291, 295.
annulata, Belone 126.
annulatus, Mastacembelus 126.
annulatus, Tylosurus 120, 126.
Anthias testudineus 334.
Aplocheilus 371, 372, 375.
Aplocheilus celebensis 371, 372, 373.
Aplocheilus javanicus 372.
Aplocheilus timorensis 372, 373.
Apterygocampus 95.
Apterygocampus epinnulatus 96.
arcticeps, Cypsilurus 180, 182.
arcticeps, Exocoetus 182.
argulus, Coelonotus 57.
argus, Coelonotus 57.
argus, Solegnathus 97.
argus, Stigmatophora 97.
argus, Stigmatopora 98.
argus, Syngnathus 57, 97.
argus var. brevicaudatus, Stigmatophora 98.
argyrostictus, Syngnathus 79, 80, 82.
Aristeus 297.
Aristeus fitzroyensis 297.
Aristeus goldiei 304.
Aristeus Loriae 294.
armatus, Solenostomus 26, 28, 29.
Arrhamphus 136, 160, 171.
Arrhamphus brevis 172.
aterrimus, Hippocampus 110.
Atherina 267, 268.
Atherina bimanensis 270.
Atherina brachypterus 269.
Atherina duodecimalis 269, 271, 272, 275.
Atherina eendrachtensis 269, 270.
Atherina endrachtensis 270.
Atherina forskåli 269, 274.
Atherina lacunosa 274.
Atherina pinguis 274, 275.
Atherina temmincki 268, 269, 271, 275.
Atherina uisila 269.
Atherina Valenciennei 272.
Atherina valenciennesi 268, 269, 272.
Atherinichthys Nouhuysi 278.
Atherinidae 196, 266, 267.
Athlennes 116, 130.
Athlennes caeruleofasciatus 131.
Athlennes hians 130, 131.
atrisignis, Cypsilurus 180, 187.
atrisignis, Exocoetus 187.
atrodorsalis, Exocoetus 174.
Aulostoma 10.
Aulostoma chinense 10.
Aulostoma sinensis 10.
Aulostoma valentini 9, 10.
Aulostomatidae 7, 8, 9.
Aulostomatinae 9.
Aulostomus 10.
Aulostomus chinensis 10.
aurantiacus, Ophicephalus 321.
aurantiacus, Ophiocephalus 321.
auronitens, Doryichthys 44.
auronitens, Microphis 45.
axillaris, Mugil 252.
bahiensis, Cypsilurus 180, 190, 193.
bahiensis, Exocoetus 190.
balinensis, Hemirhamphus 146, 152.
balinensis var. occidentalis, Hemirhamphus 153.
bankanensis, Ophiocephalus 314, 323.
baramensis, Ophiocephalus 319, 320.
barbouri, Hippocampus 111.
barracuda, Sphyraena 224.
bejeus, Colisa 341.
bejeus, Trichopodus 341.
belanak, Mugil 236.
belcheri, Ichthyocampus 91, 92, 93.
bellica, Betta 355, 363.
Belone 116, 117.
Belone annulata 126.
Belone brachyrhynchos 125.
Belone cancila 133.

Belone canciloides 133.
Belone carinata 118.
Belone caudimacula 121.
Belone caudimaculata 121, 122.
Belone choram 128, 129.
Belone coromandelica 127.
Belone crocodila 131.
Belone crocodilus 128.
Belone cylindrica 126.
belone, Esox 128, 129.
Belone gigantea 126.
Belone gracilis 131.
Belone hians 131.
Belone incisa 125.
Belone krefftii 123.
Belone leiuroides 125.
Belone leiurus 124.
Belone liuroides 125.
Belone liurus 124.
Belone macrolepis 122.
Belone melanostigma 131.
Belone melanotus 127.
Belone melanurus 126.
Belone persimilis 117, 118.
Belone platura 118.
Belone platyura 117, 118.
Belone punctulata 129.
Belone schismatorhynchus 131.
Belone strongylura 121.
Belone timucoides 126, 127.
Belone Urvillii 122.
Belonichthys 35, 37, 59.
Belonichthys fluviatilis 59, 60.
Belonichthys mento 60.
Belonichthys zambezensis 60.
Belonidae 116.
Bernsteini, Doryichthys 46.
Bernsteini, Microphis 46.
Betta 332, 352, 353.
Betta akarensis 354, 357.
Betta anabatoides 353, 354, 357.
Betta bellica 355, 363.
Betta Bleekeri 357, 359.
Betta fasciata 355, 362.
Betta fusca 354, 356.
Betta macrophthalma 360.
Betta macrostoma 353, 355.
Betta patoti 354, 359.
Betta picta 354, 357, 359, 360, 364.
Betta pugnax 355, 357, 364.
Betta rubra 354, 361.
Betta taeniata 355, 362.
Betta trifasciata 359, 360.
Betta unimaculata 353, 355.
biaculeatus, Gastrotokeus 40.
biaculeatus, Syngnathoides 40, 41.
biaculeatus, Syngnathus 40.
bicoarctata, Yozia 100, 101.
bicoarctatus, Syngnathus 101.
bicolor, Exocoetus 183.
bilobatus, Cypsilurus 180, 185.
bimanensis, Atherina 270.
biocellatus, Coelonotus 57.
biserialis, Syngnathus 82.
bistriatus, Ophiocephalus 314, 322.
bivittatus, Ophicephalus 328.
bivittatus, Ophiocephalus 322.
Bleekeri, Betta 357, 359.
Bleekeri, Corythroichthys 45.
Bleekeri, Doryichthys 45.
Bleekeri, Hemirhamphus 165.
Bleekeri, Microphis 45.
bleekeri, Mugil 252.
Bleekeri, Solenostomatichthys 26.
Bleekeri, Solenostomus 26.
blochii, Solegnathus 40.
blochii, Syngnathoides 40.
boaja, Dorichthys 47.
boaja, Doryichthys 47.
boaja, Microphis 44, 47, 92.
boaja, Syngnathus 47.
bontah, Mugil 236.
bonti, Telmatherina 279, 280.
borbonicus, Mugil 252.
borneensis, Hemiramphus 165.
borneensis, Liza 249.
borneensis, Mugil 234, 249.
borneensis, Polynemus 202, 214, 216.
brachycephalus, Exocoetus 193, 194.

brachygnathus, Sphyraena 220, 229.
Brachypteri 332.
brachypterus, Atherina 269.
brachypterus, Exocoetus 174.
brachypterus, Parexocoetus 174.
brachyrhynchos, Belone 125.
brachyrhynchus, Mastacembelus 125.
brachyrhynchus, Syngnathus 88.
brachysoma, Choeroichthys 61, 62.
brachysoma, Doryichthys 62.
brachysoma, Exocoetus 189.
brachysoma, Mugil 235.
brachysoma, Syngnathus 62.
brachysomus, Cypsilurus 189.
brachyurus, Doryichthys 45.
brachyurus, Doryrhamphus 45.
brachyurus, Microphis 43, 44, 56.
brachyurus, Solenichthys 27.
brachyurus, Solenostoma 27.
brachyurus, Syngnathus 44.
brasiliensis, Esox 162.
brevicaudatus var. of Stigmatophora argus 98.
brevidorsalis, Doryichthys 50, 51.
brevidorsalis, Doryrhamphus 51.
brevirostris, Corythoichthys 75.
brevirostris, Hemirhamphus 157, 168.
brevirostris, Microgнathus 75.
brevirostris, Syngnathus 75.
brevirostris, Zenarchopterus 164, 168.
brevis, Arrhamphus 172.
brevis, Cypsilurus 181, 192.
brevis, Oxyporhamphus 160, 172.
brevispinis, Centriscus 16.
bryanti, Agonostomus 265.
Buchanani, Panchax 374.
budi, Syngnathus 57.
buffoni, Zenarchopterus 164, 170.
Buffonis, Hemirhamphus 168, 170.
buffonis, Zenarchopterus 170.
caba, Trachyrhamphus 103.
caecus, Polynemus 199.
caeruleofasciatus, Athlennes 131.
caeruleofasciatus, Tylosurus 131.
caeruleomaculatus, Mugil 234, 250.
Callionymus sagitta 17.
cancila, Belone 133.
cancila, Xenentodon 134.
canciloides, Belone 133.
canciloides, Mastacembelus 133.
canciloides, Xenentodon 133.
Cannorhynchus 12.
Cannorhynchus immaculatus 12.
Cantori, Hemirhamphus 147.
Cantoris, Hemirhamphus 147.
Carassiops 266.
carce, Ichthyocampus 91, 92.
carce, Syngnathus 92.
carinata, Belone 118.
carinicauda, Halosaurichthys 2.
carinicauda, Halosaurus 2, 3.
catherinae, Rhombatractus 298, 303.
caudatus, Doryichthys 52.
caudatus, Doryrhamphus 52.
caudatus, Microphis 52, 54.
caudimacula, Belone 121.
caudimacula, Mastacembelus 121.
caudimaculata, Belone 121, 122.
caudocarinatus, Doryichthys 50, 51.
caudovittatus, Hemiramphus 164.
caudovittatus, Zenarchopterus 164.
celebensis, Aplocheilus 371, 372, 373.
celebensis, Haplochilus 373.
celebensis, Nomorhamphus 141.
celebensis, Telmatherina 279, 280.
Centratherina 287, 305.
Centratherina crassispinosa 305, 306.
Centriscidae 8, 18, 19.
Centriscus 16, 19, 21.
Centriscus brevispinis 16.
Centriscus cristatus 22, 23.
Centriscus gracilis 16.
Centriscus scutatus 18, 21, 22, 23.
Centriscus sumpit 16.

Centriscus velitaris 16, 17.
cephalotus, Mugil 236, 253.
cephalus, Mugil 231, 234, 253.
ceramensis, Mugil 233, 247.
Cestraeus 230, 260, 261, 264.
Cestraeus goldiei 260, 261, 262, 264
Cestraeus oxyrhynchos 263.
Cestraeus oxyrhynchus 261, 263.
Cestraeus oxyrhyncus 263.
Cestraeus plicatilis 261.
Chaetodon chinensis 346.
chena, Ophiocephalus 317.
Chilatherina 287, 307.
Chilatherina fasciata 307, 308.
Chilatherina sentaniensis 307, 309.
chinense, Aulostoma 10.
chinensis, Aulostomus 10.
chinensis, Chaetodon 346.
chinensis, Polyacanthus 347.
chinensis, Sphyraena 226.
Choeroichthys 34, 38, 60, 61.
Choeroichthys brachysoma 61, 62.
Choeroichthys sculptus 61.
Choeroichthys Valencienni 62.
choram, Belone 128, 129.
Choram, Esox 129.
choram, Mastacembelus 126.
choram, Tylosurus 129.
cirrhostomus, Mugil 256.
cobojius, Cojus 334.
Coelonotus 35, 37, 56, 57.
Coelonotus argulus 57.
Coelonotus argus 57.
Coelonotus biocellatus 57.
Coelonotus leiaspis 58.
Coelonotus liaspis 56, 57, 59, 92.
Coelonotus Vaillanti 58.
coeruleomaculata, Liza 250.
coeruleomaculatus, Mugil 250.
Cojus cobojius 334.
Colisa 341.
Colisa bejeus 341.
Colisa cotra 341.
Colisa lalius 342.
Colisa ponticeriana 341.
colisa, Trichopodus 341.
Colisa unicolor 342.
Colisa vulgaris 341.
comes, Hippocampus 110.
commersonii, Exocoetus 189.
commersonii, Hemirhamphus 156.
Commersonii, Sphyraena 224.
compressus, Syngnathus 59.
conspicillatus, Corythoichthys 103.
conspicillatus, Corythroichthys 71, 72.
conspicillatus, Halicampus 103.
conspicillatus, Syngnathus 70, 103.
convexus, Hemirhamphus 147, 159.
cora mota, Ophicephalus 321.
coromandelica, Belone 127.
coromandelica, Strongylura 128.
coromandelicus, Tylosurus 128.
coronatus, Hippocampus 108, 113.
corrugatus, Corythoichthys 70, 73, 74.
corrugatus, Syngnathus 73.
Corythoichthys 36, 38, 41, 68, 70.
Corythöichthys brevirostris 75.
Corythoichthys conspicillatus 103.
Corythoichthys corrugatus 70, 73, 74.
Corythoichthys crenulatus 69, 70, 72.
Corythoichthys fasciatus 70, 71, 73.
Corythoichthys fasciculatus 83.
Corythöichthys gastrotaenia 83.
Corythoichthys penicillus 82.
Corythoichthys spinicaudatus 76.
Corythroichthys 68.
Corythroichthys Bleekeri 45.
Corythroichthys conspicillatus 71, 72.
Corythröichthys dactyliophorus 42.
Corythroichthys elerae 71.
Corythroichthys intestinalis 71.
Corythroichthys ishigakius 71.
Corythroichthys isigakius 70.
Corythroichthys mataafae 77.
Corythroichthys quinquarius 82.

Corythroichthys sealei 72.
Corythroichthys spicifer 80.
Corythroichthys tanakae 76.
Corythroichthys trachypoma 103.
Corythroichthys waitei 71.
cotra, Colisa 341.
cotra, Trichopodus 341.
crassispinosa, Centratherina 305, 306.
crassispinosus, Rhombatractus 306.
Craterocephalus 267, 277.
Craterocephalus nouhuysi 277, 278.
crenilabis, Liza 256.
crenilabis, Mugil 234, 256.
crenilabis, Querimana 256.
crenilabris, Mugil 256.
crenulatus, Corythoichthys 69, 70, 72.
crenulatus, Syngnathus 72.
cristata, Amphisile 23.
cristatus, Centriscus 22, 23.
crocodila, Belone 131.
crocodila, Strongylura 129.
crocodilus, Belone 128.
crocodilus, Mastacembelus 127.
crocodilus, Tylosurus 120, 128.
Ctenopoma 333.
Ctenops 332, 350, 351.
Ctenops nobilis 351, 352.
Ctenops vittatus 350, 351.
cultrirostris, Trachyrhamphus 99.
cuncalus, Microphis 44.
cuncalus, Syngnathus 44.
cunnesius, Mugil 233, 239, 242.
cupanus, Macropodus 345, 346.
cupanus, Polyacanthus 346.
cuspidatus, Hemirhamphus 160.
cyanopterus, Solenichthys 26.
cyanopterus, Solenostomichthys 26.
cyanopterus, Solenostomus 24, 25, 26.
cyanospilos, Ophiocephalus 317.
cyanospilos, Syngnathus 83.
cyanospilus, Ophiocephalus 317, 319.
cyanospilus, Syngnathus 79, 83.
cylindrica, Belone 126.
cylindricus, Mugil 252.
Cyprinodontidae 370, 371.
Cypselurus katoptron 184.
Cypselurus poecilopterus 186.
Cypselurus speculiger 182.
Cypselurus spilonopterus 190.
Cypsilurus 173, 179.
Cypsilurus altipennis 180, 184, 185.
Cypsilurus altipinnis 184.
Cypsilurus arcticeps 180, 182.
Cypsilurus atrisignis 180, 187.
Cypsilurus bahiensis 180, 190, 193.
Cypsilurus bilobatus 180, 185.
Cypsilurus brachysomus 189.
Cypsilurus brevis 181, 192.
Cypsilurus gilberti 194.
Cypsilurus hexazona 180, 185.
Cypsilurus katoptron 184.
Cypsilurus micropterus 176.
Cypsilurus naresi 180, 188.
Cypsilurus nigricans 180, 183, 185.
Cypsilurus nigripennis 181, 192.
Cypsilurus oligolepis 180, 189, 193.
Cypsilurus opisthopus 180, 191.
Cypsilurus oxycephalus 180, 181.
Cypsilurus poecilopterus 179, 180, 186.
Cypsilurus rondeleti 181, 193.
Cypsilurus speculiger 180, 181.
Cypsilurus spilonotopterus 190.
Cypsilurus spilopterus 180, 187.
dactyliophorus, Acanthognathus 42.
dactyliophorus, Corythröichthys 42.
dactyliophorus, Doryichthys 42.
dactyliophorus, Microphis 42.
dactyliophorus, Syngnathus 42.
dactylophorus, Acanthognathus 42.
decem-radiatus, Mugil 252.
Deissneri, Osphromenus 348.
deissneri, Parosphromenus 348.
deissneri, Polyacanthus 348.
deokhatoides, Dorichthys 53.

deokhatoides, Doryichthys 50, 53, 55.
deokhatoides, Microphis 53.
deokhatoides, Syngnathus 53.
depressa, Fistularia 14.
depressiuscula, Stigmatophora 98.
Dermatogenys spec. 141.
Dermatogenys ebrardtii 139.
Dermogenys 136, 137.
Dermogenys ebrardti 137, 139.
Dermogenys orientalis 136, 137.
Dermogenys pusillus 137, 140.
Dermogenys sumatranus 137, 139.
Dermogenys weberi 137, 138.
diagrammicus, Polynemus 208, 209.
diplogramme, Ophiocephalus 328.
Diplopterus 368.
Diplopterus pulcher 369.
dispar, Hemirhamphus 168, 169.
dispar, Zenarchopterus 163, 164, 169.
djarong, Syngnathus 78, 79.
djarong var. of Syngnathus spicifer 79.
dobula, Mugil 253.
Dolichopteri 332.
Dorichthys boaja 47.
Dorichthys deokhatoides 53.
Dorichthys fluviatilis 53.
Doryichthys 35, 38, 42, 43, 49, 50.
Doryichthys auronitens 44.
Doryichthys Bernsteini 46.
Doryichthys Bleekeri 45.
Doryichthys boaja 47.
Doryichthys brachysoma 62.
Doryichthys brachyurus 45.
Doryichthys brevidorsalis 50, 51.
Doryichthys caudatus 52.
Doryichthys caudocarinatus 50, 51.
Doryichthys dactyliophorus 42.
Doryichthys deokhatoides 50, 53, 55.
Doryichthys elegans 104.
Doryichthys excisus 64.
Doryichthys fluviatilis 50, 55.
Doryichthys Hasseltii 44.
Doryichthys heterosoma 48.
Doryichthys ignoratus 54.
Doryichthys manadensis 46.
Doryichthys martensi 50, 54.
Doryichthys mento 60.
Doryichthys millepunctatus 44.
Doryichthys pleurotaenia 64.
Doryichthys polyacanthus 45.
Doryichthys retzii 49, 50, 52, 53.
Doryichthys sculptus 61.
Doryichthys serialis 62.
Doryichthys spaniaspis 84.
Doryichthys spinachioides 50.
Doryichthys spinosus 47, 92.
Doryichthys stictorhynchus 46.
Doryichthys valenciennii 62.
Doryichthys zambezensis 59.
Doryrhamphina 34.
Doryrhamphus 35, 37, 43, 63.
Doryrhamphus brachyurus 45.
Doryrhamphus brevidorsalis 51.
Doryrhamphus caudatus 52.
Doryrhamphus excisus 64.
Doryrhamphus macgregori 61.
Doryrhamphus melanopleura 63, 64.
Doryrhamphus mento 60.
Doryrhamphus pleurotaenia 64.
dubius, Polynemus 202, 215.
dumasi, Melanotaenia 289, 290, 296,
duodecimalis, Atherina 269, 271, 272, 275.
dussumieri, Hemirhamphus 146. 155, 162.
dussumieri Mugil 232, 235, 236, 245.
Dussumieri, Sphyraena 224.
dussumierii, Hyporhamphus 155.
dux, Zenarchopterus 164, 169.
ebrardti, Dermogenys 137, 139.
ebrardtii, Dermatogenys 139.
ebrardtii, Hemiramphus 139.
ectuntio, Esox 165.
ectuntio, Hemirhamphus 165.
ectuntio, Zenarchopterus 164, 165.
eendrachtensis, Atherina 269, 270.

Einthovenii, Polyacanthus 338.
elegans, Doryichthys 104.
elegans, Halicampus 103, 104.
elerae, Corythroichthys 71.
Eleutheronema 197, 198.
Eleutheronema tetradactylum 197, 198, 199.
Eleutheronema tridactylum 198.
elongatus, Anabas 334.
elongatus, Myxus 264.
endrachtensis, Atherina 270.
engeli, Mugil 232, 238, 239.
epinnulatus, Apterygocampus 96.
epinnulatus, Penetopteryx 96.
erinaceus, Hippocampus 109.
erythrorinchus var., Hemirhamphus 155.
erythrorhynchus, Hemirhamphus 147, 162.
Esox belone 128, 129.
Esox brasiliensis 162.
Esox Choram 129.
Esox ectuntio 165.
Esox far 156.
Esox marginatus 157.
Esox panchax 374.
excisus, Doryichthys 64.
excisus, Doryrhamphus 64.
exiliens, Exocoetus 189.
Exocoetidae 135, 173.
Exocoetoïdea 115, 134, 135.
Exocoetus 173, 177.
Exocoetus affinis 181.
Exocoetus altipennis, 184.
Exocoetus altipinnis 184.
Exocoetus arcticeps 182.
Exocoetus atrisignis 187.
Exocoetus atrodorsalis 174.
Exocoetus bahiensis 190.
Exocoetus bicolor 183.
Exocoetus brachycephalus 193, 194.
Exocoetus brachypterus 174.
Exocoetus brachysoma 189.
Exocoetus commersonii 189.
Exocoetus evolans 177.
Exocoetus exiliens 189.
Exocoetus furcatus 185.
Exocoetus gryllus 174.
Exocoetus hexazona 185.
Exocoetus hillianus 174.
Exocoetus javanicus 179.
Exocoetus katoptron 184.
Exocoetus mento 174.
Exocoetus micropterus 176.
Exocoetus naresii 188.
Exocoetus neglectus 189.
Exocoetus nigricans 183.
Exocoetus nigripennis 192.
Exocoetus obtusirostris 178.
Exocoetus oligolepis 189.
Exocoetus opisthopus 191.
Exocoetus oxycephalus 181.
Exocoetus poecilopterus 186, 187.
Exocoetus robustus 184.
Exocoetus Rondeletii 193.
Exocoetus speculiger 181, 184.
Exocoetus spilonotopterus 190.
Exocoetus spilopterus 187.
Exocoetus spilopus 183.
Exocoetus unicolor 189.
Exocoetus volans 178.
Exocoetus volitans 177, 182.
Exonautes 179.
Exonautes oxycephalus 181.
Exonautes speculiger 182.
extensus, Microphis 64.
Euleptorhamphus 135.
Eurycaulus 117.
Eurycaulus persimilis 117, 118.
Eurycaulus platyura 117, 118.
evolans, Exocoetus 177.
evolans, Halocypselus 178.
Evolantia 173, 175.
Evolantia micropterus 176.
far, Esox 156.
far, Hemirhamphus 145, 147, 156.
fasciata, Betta 355, 362.
fasciata, Chilatherina 307, 308.
fasciatus, Corythoichthys 70, 71, 73.
fasciatus, Hemirhamphus 157, 158.

fasciatus, Mugil 256.
fasciatus, Polyacanthus 341.
fasciatus, Rhombatractus 308.
fasciatus, Syngnathus 70.
fasciatus, Trichogaster 341.
fasciculatus, Corythoichthys 83.
fasciolatus, Syngnathus 79, 83.
Finschii, Amphisile 22.
Fistularia 12.
Fistularia depressa 14.
Fistularia immaculata 12.
Fistularia paradoxa 17, 27.
Fistularia petimba 11, 12, 14.
Fistularia serrata 12, 14.
Fistularia villosa 12, 13, 15.
Fistulariinae 9, 11.
fitzroyensis, Aristeus 297.
flavicauda, Sphyraena 226.
flavofasciatus, Syngnathus 70.
fluviatilis, Belonichthys 59, 60.
fluviatilis, Dorichthys 53.
fluviatilis, Doryichthys 50, 55.
fluviatilis, Hemirhamphus 140.
fluviatilis, Microphis 55.
fluviatilis, Syngnathus 55, 56, 59.
forskåli, Atherina 269, 274.
forsteri, Sphyraena 220, 223, 227.
furcatus, Exocoetus 185.
fusca, Betta 354, 356.
fuscus, Ophicephalus 321.
gachua, Ophiocephalus 314, 321.
gaimardi, Hemirhamphus 146, 150, 151, 162.
Gasterotokeus 39.
Gastrophori 34.
gastrotaenia, Corythoichthys 83
gastrotaenia, Syngnathus 80.
Gastrotokeina 34.
Gastrotokeus 39.
Gastrotokeus biaculeatus 40.
Gastrotokeus gracilis 97.
georgii, Hemirhamphus 146, 147, 148.
gertrudae, Pseudomugil 283.
gertrudei, Pseudomugil 283.
gigantea, Belone 126.
giganteus, Mastacembelus 126.
giganteus, Tylosurus 126.
gilberti, Cypsilurus 194.
Glossolepis 287, 309.
Glossolepis incisus 310.
goldiei, Aeschrichthys 262.
goldiei, Aristeus 304.
goldiei, Cestraeus 260, 261, 262, 264.
goldiei, Rhombatractus 298, 304.
goldiei, Rhombosoma 304.
goramy, Osphronemus 343, 344.
gourami, Osphromenus 344.
graciliformis, Hippocampus 108.
gracilis, Belone 131.
gracilis, Centriscus 16.
gracilis, Gastrotokeus 97.
gracilis, Mastacembelus 131.
gracilis, Stigmatophora 98.
gracilis, Syngnathus 80, 81.
Grayi, Halicampus 103.
Grayi, Syngnathus 103.
gryllus, Exocoetus 174.
guachua var. malaccensis, Ophiocephalus 321.
Güntheri, Hemirhamphus 152.
güntheri, Solegnathus 66, 67.
Güntheri, Solenognathus 67.
guttulatus, Hippocampus 110, 112.
haematopterus, Syngnathus 70.
hageni, Hemiramphus 142.
hageni, Nomorhamphus 141, 142.
Halicampus 36, 38, 102, 103.
Halicampus conspicillatus 103.
Halicampus elegans 103, 104.
Halicampus Grayi 103.
Halicampus koilomatodon 102, 103.
Haliichthys 36, 39, 105.
Haliichthys taeniophorus 105, 106.
Halocypselus evolans 178.
Halosaurichthys 2.
Halosaurichthys carinicauda 2.
Halosaurichthys nigerrimus 6.
Halosauridae 1, 2.
Halosauropsis 2, 4.

Halosauropsis affinis 4, 5, 6.
Halosauropsis macrochir 4.
Halosauropsis mediorostris 4.
Halosaurus 2.
Halosaurus affinis 5.
Halosaurus anguilliformis 5.
Halosaurus carinicauda 2, 3.
Halosaurus hoskynii 5.
Halosaurus mediorostris 4, 5.
Halosaurus nigerrimus 6.
Haplochilus 371, 374.
Haplochilus celebensis 373.
Haplochilus javanicus 372.
Haplochilus javanicus v. trilineata 372.
Haplochilus panchax 374, 375.
Haplochilus sarasinorum 378.
Hardwickei, Solenognathus 67.
Hasseltii, Doryichthys 44.
hasselti, Polyacanthus 337, 338.
hawaiensis, Macrorhamphosus 16.
Helfrichii, Polyacanthus 338.
Helfrichii, Syngnathus 79.
Helostoma 312, 330, 331, 332, 339.
Helostoma oligacanthum 339.
Helostoma tambakkan 340.
Helostoma temmincki 339, 340.
Hemiramphus borneensis 165.
Hemiramphus caudovittatus 164.
Hemiramphus ebrardtii 139.
Hemiramphus hageni 142.
Hemiramphus Kampeni 167.
Hemiramphus Lutkei 157.
Hemiramphus novae-guineae 167.
Hemiramphus rasori 166.
Hemiramphus spec. 141, 159, 160.
Hemiramphus tridentifer 150.
Hemirhamphidae 135, 136.
Hemirhamphodon 136, 142, 143.
Hemirhamphodon kükenthali 144.
Hemirhamphodon phaiosoma 143.
Hemirhamphodon pogonognathus 143, 144.
Hemirhamphus 136, 145, 146, 160.
Hemirhamphus amblyurus 165.
Hemirhamphus balinensis 146, 152.
Hemirhamphus balinensis var. occidentalis 153.
Hemirhamphus Bleekeri 165.
Hemirhamphus brevirostris 157, 168.
Hemirhamphus Buffonis 168, 170.
Hemirhamphus Cantori 147.
Hemirhamphus Cantoris 147.
Hemirhamphus commersonii 156.
Hemirhamphus convexus 147, 159.
Hemirhamphus cuspidatus 160.
Hemirhamphus dispar 168, 169.
Hemirhamphus dussumieri 146, 155, 162.
Hemirhamphus ectuntio 165.
Hemirhamphus erythrorhynchus 147, 162.
Hemirhamphus erythrorinchus var. 155.
Hemirhamphus far 145, 147, 156.
Hemirhamphus fasciatus 157, 158.
Hemirhamphus fluviatilis 140.
Hemirhamphus gaimardi 146, 150, 151, 162.
Hemirhamphus georgii 146, 147, 148.
Hemirhamphus Güntheri 152.
Hemirhamphus intermedius 152.
Hemirhamphus limbatus 150.
Hemirhamphus longirostris 147.
Hemirhamphus lucens 147, 162.
Hemirhamphus marginatus 147, 149, 157.
Hemirhamphus melanurus 146, 151, 172.
Hemirhamphus neglectus 149.
Hemirhamphus orientalis 137.
Hemirhamphus phaiosoma 143.
Hemirhamphus pogonognathus 144.
Hemirhamphus quoyi 146, 154.
Hemirhamphus Reynaldi 155.
Hemirhamphus russelli 147, 157, 161.
Hemirhamphus striga 170.

Hemirhamphus sumatranus 139.
Hemirhamphus unifasciatus 146, 149.
Hemirhamphus weberi 138.
Hemirhamphus xanthopterus 162.
Hemithylacus leiaspis 57, 59.
Hemithylacus Rocaberti 60.
heptadactylum, Trichidion 212.
heptadactylus, Polynemus 202, 212.
heptagonus, Hippichthys 92.
heptagonus, Syngnathus 92.
heterocheilos, Mugil 258.
heterochilus, Mugil 234, 258.
Heteromi 1.
heterosoma, Doryichthys 48.
heterosoma, Microphis 44, 48.
heterosoma, Syngnathus 48.
hexanemus, Polynemus 202, 207.
hexazona, Cypsilurus 180, 185.
hexazona, Exocoetus 185.
hians, Athlennes 130, 131.
hians, Belone 131.
hilleri, Trichidion 214.
hillianus, Exocoetus 174.
hilonis, Hippocampus 110.
Hippichthys heptagonus 92.
Hippocampina 36.
Hippocampus 31, 36, 39, 106, 107.
Hippocampus abdominalis 107, 108.
Hippocampus aterrimus 110.
Hippocampus barbouri 111.
Hippocampus comes 110.
Hippocampus coronatus 108, 113.
Hippocampus erinaceus 109.
Hippocampus graciliformis 108.
Hippocampus guttulatus 110, 112.
Hippocampus hilonis 110.
Hippocampus histrix 108, 109.
Hippocampus hystrix 109.
Hippocampus kampylotrachelos 112.
Hippocampus kelloggi 110.
Hippocampus kuda 108, 110.
Hippocampus manadensis 112.
Hippocampus mannulus 112.
Hippocampus melanospilos 110.
Hippocampus moluccensis 110.
Hippocampus polytaenia 110.
Hippocampus rhynchomacer 110.
Hippocampus spinosissimus 107, 108, 109.
Hippocampus taeniops 110.
Hippocampus taeniopterus 110.
Hippocampus trimaculatus 108, 112.
histrix, Hippocampus 108, 109.
hoskynii, Halosaurus 5.
Hunnii, Syngnathus 80.
Hyporhamphus dussumierii 155.
Hyporhamphus neglectus 149.
Hyporhamphus quoyi 154.
Hyporhamphus unifasciatus 149.
hypselosoma, Mugil 254.
hystrix, Hippocampus 109.
Ichthyocampus 36, 38, 90, 91.
Ichthyocampus belcheri, 91, 92, 93.
Ichthyocampus carce 91, 92.
Ichthyocampus kampeni 91, 92, 93.
Ichthyocampus papuensis 70.
Ichthyocampus pondicerianus 92.
Ichthyocampus ponticerianus 92.
ignoratus, Doryichthys 54.
ignoratus, Microphis 54.
immaculata, Fistularia 12.
immaculatus, Cannorhynchus 12.
incisa, Belone 125.
incisus, Glossolepis 310.
incisus, Tylosurus 120, 125.
indicum, Trichidion 205.
indicus, Polynemus 201, 205.
intermedius, Hemirhamphus 152.
intestinalis, Corythroichthys 71.
intestinalis, Syngnathus 70.
ishigakius, Corythroichthys 71.
isigakius, Corythroichthys 70.
Jagorii, Microphis 46.
japonica, Sphyraena 220, 225.
japonicus, Mugil 253.

javanicus, Aplocheilus 372.
javanicus, Exocoetus 179.
javanicus, Haplochilus 372.
javanicus, Mugil 235.
javanicus v. trilineata, Haplochilus 372.
jello, Sphyraena 219, 220.
Joturus 265.
Jouani, Microphis 45.
Jullieni, Syngnathus 47.
Kampeni, Hemiramphus 167.
kampeni, Ichthyocampus 91, 92, 93
kampeni, Zenarchopterus 164, 167.
kampylotrachelos, Hippocampus 112.
katoptron, Cypselurus 184.
katoptron, Cypsilurus 184.
katoptron, Exocoetus 184.
kelaartii, Mugil 238.
kelaarti, Ophiocephalus 321.
kelloggi, Hippocampus 110.
kochi, Rhombatractus 297, 298, 302.
koilomatodon, Halicampus 102, 103.
koilomatodon, Syngnathus 103.
krefftii, Belone 123.
krefftii, Stenocaulus 123.
kreffti, Tylosurus 120, 123, 134.
kruyti, Adrianichthys 376, 380, 381.
kuda, Hippocampus 108, 110.
Kuhlii, Panchax 374.
Kuhlii, Polyacanthus 338.
Kuhlii, Syngnathus 83.
kükenthali, Hemirhamphodon 144.
kuru, Polydactylus 209.
kuru, Polynemus 202, 209.
kuru, Trichidion 209.
Labidorhamphus 164.
labiosus, Mugil 231, 235, 259.
Labrus opercularis 346.
Labrus trichopterus 366.
Labyrinthici 312.
lacunosa, Atherina 274.
lalius, Colisa 342.
lalius, Trichogaster 341, 342.
lalius, Trichopodus 342.
langsar, Sphyraena 220, 228, 229.
lankesteri, Neostethus 381, 382.
leeri, Trichopodus 366, 367.
Leerii, Trichopus 367.
leerii, var. of Osphromenus trichopterus 367.
leiaspis, Coelonotus 58.
leiaspis, Hemithylacus 57, 59.
leiaspis, Syngnathus 57.
leiura, Strongylura 124.
leiuroides, Belone 125.
leiuroides, Mastacembelus 125.
leiuroides, Strongylura 125.
leiuroides, Tylosurus 125.
leiurus, Belone 124.
leiurus, Mastacembelus 124.
leiurus, Tylosurus 120, 124.
leptosoma, Solenostomus 28.
lettiensis, Solegnathus 65, 66.
lettiensis, Solenognathus 66.
lettiensis, Solenostomus 66.
liaspis, Coelonotus 56, 57, 59, 92.
limbatus, Hemirhamphus 150.
limbatus, Ophicephalus 321.
lineatus, Polynemus 202.
Lipogenyidae 1.
liuroides, Belone 125.
liuroides, Mastacembelus 125.
liurus, Belone 124.
Liza borneensis 249.
Liza coeruleomaculata 250.
Liza crenilabis 256.
Liza melinoptera 246.
Liza troscheli 248.
Liza waigiensis 244.
longifilis, Polynemus 215.
longimanus, Mugil 232, 239.
longipectoralis, Polynemus 202, 213.
longirostris, Hemirhamphus 147.
Lophobranchii 7.
lorentzi, Rhombatractus 298, 300.
lorentzii, Rhombosoma 300.
Loriae, Aristeus 294.

loriae, Melanotaenia 289, 294.
loriae, Rhombatractus 294.
lucens, Hemirhamphus 147, 162.
Luciocephalidae 331, 368.
Luciocephalus 368.
Luciocephalus pulcher 369.
lucius, Ophicephalus 326.
lucius, Ophiocephalus 314, 323, 325, 326.
Lutjanus scandens 334.
Lutjanus testudo 334.
Lutkei, Hemiramphus 157.
macgregori, Doryrhamphus 61.
macrocephalus, Anabas 334.
macrocheilos, Mugil 257.
macrochilus, Mugil 234, 257.
macrochir, Halosauropsis 4.
macrolepidotus, Mugil 244, 253.
macrolepis, Belone 122.
macrolepis, Mastacembelus 122.
macrolepis, Mugil 245.
macrolepis, Tylosurus 120, 122.
macronema, Polynemus 214.
macrophthalma, Amphisile 22.
macrophthalma, Betta 360.
macrophthalmus, Polynemus 202, 216.
Macropodus 330, 331, 332, 345.
Macropodus cupanus 345, 346.
Macropodus ocellatus 347.
Macropodus opercularis 345, 346.
Macropodus pugnax 364.
Macropodus venustus 347.
Macropodus viridi-auratus 346.
Macropus 345.
Macropus viridi-auratus 347.
Macrorhamphosidae 7, 15.
Macrorhamphosus 16.
Macrorhamphosus hawaiensis 16.
Macrorhamphosus scolopax 15.
Macrorhamphosus velitaris 16, 17.
macrostoma, Betta 353, 355.
maculata, Melanotaenia 289, 292.
malaccensis var. of Ophiocephalus guachua 321.
malayanus, Osphromenus 349.
manadensis, Doryichthys 46.
manadensis, Hippocampus 112.
manadensis, Microphis 44, 46.
manadensis, Syngnathus 46.
mannulus, Hippocampus 112.
marginatus, Esox 157.
marginatus, Hemirhamphus 147, 149, 157.
marginatus, Ophicephalus 321.
martensi, Doryichthys 50, 54.
Martensii, Syngnathus 54.
marulioides, Ophiocephalus 314, 315.
marulius, Ophiocephalus 316.
Mastacembelus anastomella 124.
Mastacembelus annulatus 126.
Mastacembelus brachyrhynchus 125.
Mastacembelus canciloides 133.
Mastacembelus caudimacula 121.
Mastacembelus choram 126.
Mastacembelus crocodilus 127.
Mastacembelus giganteus 126.
Mastacembelus gracilis 131.
Mastacembelus leiuroides 125.
Mastacembelus leiurus 124.
Mastacembelus liuroides 125.
Mastacembelus macrolepis 122.
Mastacembelus melanotus 127.
Mastacembelus platurus 118.
Mastacembelus schismatorhynchus 131.
Mastacembelus strongylurus 121.
mataafae, Corythroichthys 77.
mataafae, Microgrnathus 75, 77.
mataafae, Syngnathus 77.
mediorostris, Halosauropsis 4.
mediorostris, Halosaurus 4, 5.
melanochir, Mugil 244.
melanochir, Polynemus 202, 211.
melanopleura, Doryrhamphus 63, 64.
melanopleura, Syngnathus 64.
melanopterus, Mugil 246.

melanopterus, Ophiocephalus 313, 314, 315.
melanosoma, Ophiocephalus 314, 319.
melanospilos, Hippocampus 110.
melanostigma, Belone 131.
Melanotaenia 287, 289, 297.
Melanotaenia dumasi 289, 290, 296.
Melanotaenia loriae 289, 294.
Melanotaenia maculata 289, 292.
Melanotaenia multisquamata 289, 290.
Melanotaenia nigrans 291, 292, 293, 295.
Melanotaenia ogilbyi 288, 289, 293.
Melanotaenia patoti 286, 289, 291.
Melanotaenia rubrostriata 289, 295.
Melanotaeniinae 267, 286, 287.
melanotopterus, Panchax 374.
melanotus, Belone 127.
melanotus, Mastacembelus 127.
melanotus, Tylosurus 119, 120, 127.
melanurus, Belone 126.
melanurus, Hemirhamphus 151, 172.
melasoma, Ophicephalus 319.
melinoptera, Liza 246.
melinopterus, Mugil, 233, 246.
mento, Belonichthys 60.
mento, Doryichthys 60.
mento, Doryrhamphus 60.
mento, Exocoetus 174.
mento, Parexocoetus 174.
mento, Syngnathus 59.
mesogaster, Parexocoetus 174.
Meyeri, Mugil 235.
microcephalus, Anabas 334.
Microcyprini 370.
Microgнathus 36, 38, 74, 75.
Micrognathus brevirostris 75.
Micrognathus mataafae 75, 77.
micrognathus, Syngnathus 59, 92.
micropeltes, Ophicephalus 328.
micropeltes, Ophiocephalus 315, 328.
Microphis 35, 38, 42, 43, 44, 49.
Microphis auronitens 45.
Microphis Bernsteini 46.
Microphis Bleekeri 45.
Microphis boaja 44, 47, 92.
Microphis brachyurus 43, 44, 56.
Microphis caudatus 52, 54.
Microphis cuncalus 44.
Microphis dactyliophorus 42.
Microphis deokhatoides 53.
Microphis extensus 64.
Microphis fluviatilis 55.
Microphis heterosoma 44, 48.
Microphis ignoratus 54.
Microphis Jagorii 46.
Microphis Jouani 45.
Microphis manadensis, 44, 46.
Microphis ocellatus 61.
Microphis pleurotaenia 64.
Microphis sculptus 61.
Microphis tenuis 80.
micropterus, Cypsilurus 176.
micropterus, Evolantia 176.
micropterus, Exocoetus 176.
micropterus, Syngnathus 59.
microstoma, Polynemus 201, 204.
microstoma, Trichidion 204.
millepunctatus, Doryichthys 44.
moluccensis, Hippocampus 110.
montanus, Ophiocephalus 321.
monticola, Agonostomus 265.
mossambicus, Syngnathus 83.
Mugil 230, 231, 232, 260, 264.
Mugil adustus 249.
Mugil alcocki 243.
Mugil axillaris 252.
Mugil belanak 236.
Mugil bleekeri 252.
Mugil bontah 236.
Mugil borbonicus 252.
Mugil borneensis 234, 249.
Mugil brachysoma 235.
Mugil caeruleomaculatus 234, 250.
Mugil cephalotus 236, 253.
Mugil cephalus 231, 234, 253.

Mugil ceramensis 233, 247.
Mugil cirrhostomus 256.
Mugil coeruleomaculatus 250.
Mugil crenilabis 234, 256.
Mugil crenilabris 256.
Mugil cunnesius 233, 239, 242.
Mugil cylindricus 252.
Mugil decem-radiatus 252.
Mugil dobula 253.
Mugil dussumieri 232, 235, 236, 245.
Mugil engeli 232, 238, 239.
Mugil fasciatus 256.
Mugil heterocheilos 258.
Mugil heterochilus 234, 258.
Mugil hypselosoma 254.
Mugil japonicus 253.
Mugil javanicus 235.
Mugil kelaartii 238.
Mugil labiosus 231, 235, 259.
Mugil longimanus 232, 239.
Mugil macrocheilos 257.
Mugil macrochilus 234, 257.
Mugil macrolepidotus 244, 253.
Mugil macrolepis 245.
Mugil melanochir 244.
Mugil melanopterus 246.
Mugil melinopterus 233, 246.
Mugil Meyeri 235.
Mugil oligolepis 233, 245.
Mugil ophuyseni 232, 240.
Mugil öur 253.
Mugil parsia 252.
Mugil planiceps 236, 256.
Mugil Rossii 244.
Mugil rüppellii 256.
Mugil seheli 234, 251, 252.
Mugil speigleri 233, 241.
Mugil subviridis 233, 243.
Mugil sundanensis 235.
Mugil tade 232, 236.
Mugil troscheli 233, 248.
Mugil vaigiensis, 233, 244.
Mugil Valenciennesii 235.
Mugil waigiensis 244.
Mugilidae 196, 229, 230, 266.
Mugiloidei 196.
multifilis, Polynemus 202, 217.
multifilis, Trichidion 217.
multisquamata, Melanotaenia 289, 290.
mystax, Ophicephalus 319.
mystax, Ophiocephalus 319.
Myxus 230, 264.
Myxus elongatus 264.
Nannocampus 35, 37, 94.
Nannocampus subosseus 95.
Nannocampus weberi 94, 95.
naresi, Cypsilurus 180, 188.
naresii, Exocoetus 188.
neglectus, Exocoetus 189.
neglectus, Hemirhamphus 149.
neglectus, Hyporhamphus 149.
Nematocentris 287.
Nematocentris novae-guineae 304.
Nematocentris rubrostriatus 295.
Neoatherina 288.
Neostethus 382.
Neostethus lankesteri 381, 382.
nigerrimus, Halosaurichthys 6.
nigerrimus, Halosaurus 6.
nigrans, Melanotaenia 291, 292, 293, 295.
nigricans, Cypsilurus 180, 183, 185.
nigricans, Exocoetus 183.
nigripennis, Cypsilurus 181, 192.
nigripennis, Exocoetus 192.
nobilis, Ctenops 351, 352.
nobilis, Osphromenus 352.
Nomorhamphus 136, 141.
Nomorhamphus celebensis 141.
Nomorhamphus hageni 141, 142.
Notacanthidae 1.
Nouhuysi, Atherinichthys 278.
nouhuysi, Craterocephalus 277, 278.
novae-guineae, Hemiramphus 167.
novae-guineae, Nematocentris 304.
novae-guineae, Pseudomugil 283, 284.
novae-guineae, Rhombatractus 304.

novae-guineae, Rhombosoma 302, 303, 304.
novae-guineae, Zenarchopterus 164, 167.
obtusata, Sphyraena 220, 226.
obtusirostris, Exocoetus 178.
occidentalis var. of Hemirhamphus balinensis 153.
ocellatus, Macropodus 347.
ocellatus, Microphis 61.
ogilbyi, Melanotaenia 288, 289, 293.
olfax, Osphromenus 344.
oligacanthum, Helostoma 339.
oligolepis, Anabas 334, 336.
oligolepis, Cypsilurus 180, 189, 193.
oligolepis, Exocoetus 189.
oligolepis, Mugil 233, 245.
olivacea, Stigmatophora 97.
opercularis, Labrus 346.
opercularis, Macropodus 345, 346.
opercularis, Polyacanthus 347.
opercularis, Pseudosphromenus 347.
Ophicephalus aurantiacus 321.
Ophicephalus bivittatus 328.
Ophicephalus cora-mota 321.
Ophicephalus fuscus 321.
Ophicephalus limbatus 321.
Ophicephalus lucius 326.
Ophicephalus marginatus 321.
Ophicephalus melasoma 319.
Ophicephalus micropeltes 328.
Ophicephalus mystax 319.
Ophicephalus planiceps 317.
Ophicephalus pleurophthalmus 324.
Ophicephalus polylepis 326.
Ophicephalus rhodotaenia 319.
Ophicephalus sowarah 317.
Ophicephalus spiritalis 324, 325.
Ophicephalus Stevensii 328.
Ophicephalus striatus 317.
Ophicephalus urophthalmus 324.
Ophiocephaloidei 312, 313.
Ophiocephalus 313, 314, 325.
Ophiocephalus affinis 330.
Ophiocephalus aurantiacus 321.
Ophiocephalus bankanensis 314, 323.
Ophiocephalus baramensis 319, 320.
Ophiocephalus bistriatus 314, 322.
Ophiocephalus bivittatus 322.
Ophiocephalus chena 317.
Ophiocephalus cyanospilos 317.
Ophiocephalus cyanospilus 317, 319.
Ophiocephalus diplogramme 328.
Ophiocephalus gachua 314, 321.
Ophiocephalus guachua var. malaccensis 321.
Ophiocephalus kelaarti 321.
Ophiocephalus lucius 314, 323, 325, 326.
Ophiocephalus marulioides 314, 315.
Ophiocephalus marulius 316.
Ophiocephalus melanopterus 313, 314, 315.
Ophiocephalus melanosoma 314, 319.
Ophiocephalus micropeltes 315, 328.
Ophiocephalus montanus 321.
Ophiocephalus mystax 319.
Ophiocephalus pleurophthalmus 314, 324.
Ophiocephalus polylepis 326, 327.
Ophiocephalus punctatus 315, 330.
Ophiocephalus rhodotaenia 319, 320.
Ophiocephalus serpentinus 328.
Ophiocephalus striatus 314, 317.
Ophiocephalus studeri 328.
Ophiocephalus vagus 317.
Ophiocephalus wrahl 317.
ophuyseni, Mugil 232, 240.
opisthopus, Cypsilurus 180, 191.
opisthopus, Exocoetus 191.
orientalis, Dermogenys 136, 137.

orientalis, Hemirhamphus 137.
Orthichthys 16.
Orthichthys velitaris 16.
Oryzias 371.
osphromenoides, Sphaerichthys 349.
Osphromenus 343.
Osphromenus Deissneri 348.
Osphromenus gourami 344.
Osphromenus malayanus 349.
Osphromenus nobilis 352.
Osphromenus olfax 344.
Osphromenus siamensis 366.
Osphromenus striatus 351.
Osphromenus trichopterus 366.
Osphromenus trichopterus var. leerii 367.
Osphromenus vittatus 351.
Osphronemus 332, 343.
Osphronemus goramy 343, 344.
Osphronemus satyrus 344.
öur, Mugil 253.
oxycephalus, Cypsilurus 180, 181.
oxycephalus, Exocoetus 181.
oxycephalus, Exonautes 181.
Oxyporhamphus 160.
Oxyporhamphus brevis 160, 172.
oxyrhynchos, Cestraeus 263.
oxyrhynchum, Agonostoma 263.
oxyrhynchus, Cestraeus 261, 263.
oxyrhyncus, Cestraeus 263.
pachyacanthus, Acentrachme 22.
paludosus, Polyacanthus 347.
Panchax 371, 374.
Panchax Buchanani 374.
panchax, Esox 374.
panchax, Haplochilus 374, 375.
Panchax Kuhlii 374.
Panchax melanotopterus 374.
Panchax panchax 374, 376.
panchax, Panchax 374, 376.
Panchax pictum 360.
papuensis, Ichthyocampus 70.
paradiseus, Polynemus 202, 218.
paradoxa, Fistularia 17, 27.
paradoxum, Solenostoma 26.
paradoxus, Solenichthys 27.
paradoxus, Solenostoma 26.
paradoxus, Solenostomatichthys 27.
paradoxus, Solenostomus 17, 26, 27, 29.
Parasyngnathus 78.
Parexocoetus 173.
Parexocoetus brachypterus 174.
Parexocoetus mento 174.
Parexocoetus mesogaster 174.
Parophiocephalus 352.
Parophiocephalus unimaculatus 355.
Parosphromenus 332, 347, 348.
Parosphromenus deissneri 348.
parsia, Mugil 252.
parviceps, Syngnathus 79.
patoti, Betta 354, 359.
patoti, Melanotaenia 286, 289, 291.
patoti, Rhombatractus 291.
pelagicus, Syngnathus 79, 87.
Penetopteryx 35, 37, 95.
Penetopteryx epinnulatus 96.
penicillus, Corythoichthys 82.
penicillus, Syngnathus 82.
Perca scandens 334.
Percesoces 195.
persimilis, Belone 117, 118.
persimilis, Eurycaulus 117, 118.
petimba, Fistularia 11, 12, 14.
pfeifferi, Polydactylus 208.
pfeifferi, Polynemus 202, 208.
phaiosoma, Hemirhamphodon 143.
phaiosoma, Hemirhamphus 143.
Phallostethidae 370, 381.
Philypnoides surakartensis 321.
Phyllopteryx 105.
Phyllopteryx taeniophorus 106.
picta, Betta 354, 357, 359, 360, 364.
pictum, Panchax 360.
picuda, Sphyraena 220, 224
picuda var. of Sphyraena sphyraena 224.
pinguis, Atherina 274, 275.

planiceps, Mugil 236, 256.
planiceps, Ophicephalus 317.
platura, Belone 118.
platurus, Mastacembelus 118.
Platybelone 117.
platyura, Belone 117, 118.
platyura, Eurycaulus 117, 118.
plebeius, Polydactylus 203.
plebejus, Polynemus 201, 202, 204.
plebejus, Trichidion 202.
pleurophthalmus, Ophicephalus 324.
pleurophthalmus, Ophiocephalus, 314, 324.
pleurotaenia, Doryichthys 64.
pleurotaenia, Doryrhamphus 64.
pleurotaenia, Microphis 64.
plicatile, Agonostoma 261.
plicatilis, Cestraeus 261.
poecilopterus, Cypselurus 186.
poecilopterus, Cypsilurus 179, 180, 186.
poecilopterus, Exocoetus 186, 187.
pogonognathus, Hemirhamphodon 143, 144.
pogonognathus, Hemirhamphus 144.
Polyacanthus 332, 337, 345.
Polyacanthus chinensis 347.
Polyacanthus cupanus 346.
Polyacanthus deissneri 348.
polyacanthus, Doryichthys 45.
Polyacanthus Einthovenii 338.
Polyacanthus fasciatus 341.
Polyacanthus hasselti 337, 338.
Polyacanthus Helfrichii 338.
Polyacanthus Kuhlii 338.
Polyacanthus opercularis 347.
Polyacanthus paludosus 347.
polyacanthus, Syngnathus 44.
Polydactylus 200.
Polydactylus agonasi 203.
Polydactylus kuru 209.
Polydactylus pfeifferi 208.
Polydactylus plebeius 203.
polydactylus, Polynemus 217.
Polydactylus rhadinus 199.
Polydactylus tetradactylus 199.
Polydactylus zophomus 204.
polylepis, Ophicephalus 326.
polylepis, Ophiocephalus 326, 327.
Polynemidae 195, 196, 197.
Polynemus 197, 200, 201.
Polynemus agonasi 203.
Polynemus borneensis 202, 214, 216.
Polynemus caecus 199.
Polynemus diagrammicus 208, 209.
Polynemus dubius 202, 215.
Polynemus heptadactylus 202, 212.
Polynemus hexanemus 202, 207.
Polynemus indicus 201, 205.
Polynemus kuru 202, 209.
Polynemus lineatus 202.
Polynemus longifilis 215.
Polynemus longipectoralis 202, 213.
Polynemus macronema 214.
Polynemus macrophthalmus 202, 216.
Polynemus melanochir 202, 211.
Polynemus microstoma 201, 204.
Polynemus multifilis 202, 217.
Polynemus paradiseus 202, 218.
Polynemus pfeifferi 202, 208.
Polynemus plebejus 201, 202, 204.
Polynemus polydactylus 217.
Polynemus quadrifilis 199.
Polynemus quaterdecimfilis 217.
Polynemus salliah 199.
Polynemus sele 205.
Polynemus sextarius 202, 210.
Polynemus taeniatus 202.
Polynemus teria 199.
Polynemus tetradactylus 199.
Polynemus tridactylus 198.
Polynemus uronemus 205.
Polynemus zophomus 204.
Polypterichthys 10.
Polypterichthys Valentini 10.
polytaenia, Hippocampus 110.

pondicerianus, Ichthyocampus 92.
ponticeriana, Colisa 341.
ponticerianus, Ichthyocampus 92.
poptae, Xenopoecilus 377, 378, 379.
praecox, Rhombatractus 298.
Pseudomugil 267, 282, 283.
Pseudomugil gertrudae 283.
Pseudomugil gertrudei 283.
Pseudomugil novae-guineae 283, 284.
Pseudosphromenus 345.
Pseudosphromenus opercularis 347.
pugnax, Betta 355, 357, 364.
pugnax, Macropodus 364.
pulcher, Diplopterus 369.
pulcher, Luciocephalus 369.
punctatus, Ophiocephalus 315, 330.
punctatus, Syngnathus 79, 86.
punctulata, Belone 129.
punctulatus, Tylosurus 120, 129.
pusillus, Dermogenys 137, 140.
quadrifilis, Polynemus 199.
quaterdecimfilis, Polynemus 217.
Querimana crenilabis 256.
quoyi, Hemirhamphus 146, 154.
quoyi, Hyporhamphus 154.
quinquarius, Corythroichthys 82.
rasori, Hemiramphus 166.
rasori, Zenarchopterus 164, 166.
retzii, Doryichthys 49, 50, 52, 53.
Retzii, Syngnathus 52.
Reynaldi, Hemirhamphus 155.
rhadinus, Polydactylus 199.
rhodotaenia, Ophicephalus 319.
rhodotaenia, Ophiocephalus 319, 320.
Rhombatractus 287, 296.
Rhombatractus affinis 304.
Rhombatractus catherinae 298, 303.
Rhombatractus crassispinosus 306.
Rhombatractus fasciatus 308.
Rhombatractus goldiei 298, 304.
Rhombatractus kochi 297, 298, 302.
Rhombatractus lorentzi 298, 300.
Rhombatractus loriae 294.
Rhombatractus novae-guineae 304.
Rhombatractus patoti 291.
Rhombatractus praecox 298.
Rhombatractus rubrostriatus 295.
Rhombatractus senckenbergianus 304.
Rhombatractus sentaniensis 309.
Rhombatractus vanheurni 298, 299.
Rhombatractus weberi 304.
Rhombosoma 296, 297.
Rhombosoma goldiei 304.
Rhombosoma lorentzii 300.
Rhombosoma novae-guineae 302, 303, 304.
rhynchomacer, Hippocampus 110.
rivalis var. of Syngnathus spicifer 79.
robustus, Exocoetus 184.
Rocaberti, Hemithylacus 60.
rondeleti, Cypsilurus 181, 193.
Rondeletii, Exocoetus 193.
Rossii, Mugil 244.
rubra, Betta 354, 361.
rubrostriata, Melanotaenia 289, 295.
rubrostriatus, Anisocentrus 291, 295.
rubrostriatus, Nematocentris 295.
rubrostriatus, Rhombatractus 295.
rüppellii, Mugil 256.
russelli, Hemirhamphus 147, 157, 161.
sagitta, Callionymus 17.
salliah, Polynemus 199.
sarasinorum, Haplochilus 378.
sarasinorum, Xenopoecilus 378.
satyrus, Osphronemus 344.
scandens, Anabas 334.
scandens, Lutjanus 334.
scandens, Perca 334.
scandens, Sparus 334.
scansor, Amphiprion 334.
schismatorhynchus, Belone 131.
schismatorhynchus, Mastacembelus 131.
schismatorhynchus, Tylosurus 131.

Schlegeli, Syngnathus 44, 88.
scolopax, Macrorhamphosus 15.
Scombresocoidea 115.
sculptus, Choeroichthys 61.
sculptus, Doryichthys 61.
sculptus, Microphis 61.
scutata, Acentrachme 22.
scutata, Amphisile 20, 22.
scutatus, Centriscus 18, 21, 22, 23.
sealei, Corythroichthys 72.
sectarium, Trichidion 210.
seheli, Mugil 234, 251, 252.
sele, Polynemus 205.
senckenbergianus, Rhombatractus 304.
sentaniensis, Chilatherina 307, 309.
sentaniensis, Rhombatractus 309.
sepat, Trichopus 366.
serialis, Doryichthys 62.
serpentinus, Ophiocephalus 328.
serrata, Fistularia 12, 14.
serratus, Syngnathus 99.
serratus, Trachyrhamphus 99.
sextarius, Polynemus 202, 210.
sextarius, Trichidion 210.
siamensis, Osphromenus 366.
siamensis, Trichopus 366.
sinensis, Aulostoma 10.
Siphonostoma typhle 31.
Siphostoma 79.
Siphostoma yoshi 58.
snodgrassi, Sphyraena 224.
Solegnathus 35, 39, 65, 66.
Solegnathus argus 97.
Solegnathus blochii 40.
Solegnathus güntheri 66, 67.
Solegnathus lettiensis 65, 66.
Solenichthyes 7.
Solenichthys brachyurus 27.
Solenichthys cyanopterus 26.
Solenichthys paradoxus 27.
Solenognathina 35.
Solenognathus 65.
Solenognathus Güntheri 67.
Solenognathus Hardwickei 67.
Solenognathus lettiensis 66.
Solenostoma brachyurus 27.
Solenostoma paradoxum 26.
Solenostoma paradoxus 26.
Solenostomatichthys Bleekeri 26.
Solenostomatichthys paradoxus 27.
Solenostomichthys cyanopterus 26.
Solenostomidae 8, 24.
Solenostomus 25, 26.
Solenostomus armatus 26, 28, 29.
Solenostomus Bleekeri 26.
Solenostomus cyanopterus 24, 25, 26.
Solenostomus leptosoma 28.
Solenostomus lettiensis 66.
Solenostomus paradoxus 17, 26, 27, 29.
sowarah, Ophicephalus 317.
spaniaspis, Doryichthys 84.
Sparus scandens 334.
Sparus testudineus 334.
speculiger, Cypselurus 182.
speculiger, Cypsilurus 180, 181.
speculiger, Exocoetus 181, 184.
speculiger, Exonautes 182.
speigleri, Mugil 233, 241.
Sphaerichthys 332, 348.
Sphaerichthys osphromenoides 349.
Sphyraena 219, 220.
Sphyraena agam 224.
Sphyraena altipinnis 220, 222.
Sphyraena barracuda 224.
Sphyraena brachygnathus 220, 229.
Sphyraena chinensis 226.
Sphyraena Commersonii 224.
Sphyraena Dussumieri 224.
Sphyraena flavicauda 226.
Sphyraena forsteri 220, 223, 227.
Sphyraena japonica 220, 225.
Sphyraena jello 219, 220.
Sphyraena langsar 220, 228, 229.
Sphyraena obtusata 220, 226.
Sphyraena picuda 220, 224.
Sphyraena snodgrassi 224.
Sphyraena sphyraena 224.

sphyraena, Sphyraena 224.
Sphyraena sphyraena var. picuda 224.
Sphyraena strenua 226.
Sphyraena toxeuma 223.
sphyraena var. picuda, Sphyraena 224.
Sphyraenidae 195, 218.
spicifer, Corythroichthys 80.
spicifer, Syngnathus 78, 79, 80, 82.
spicifer var. djarong, Syngnathus 79.
spicifer var. rivalis, Syngnathus 79.
spilonopterus, Cypselurus 190.
spilonotopterus, Cypsilurus 190.
spilonotopterus, Exocoetus 190.
spilopterus, Cypsilurus 180, 187.
spilopterus, Exocoetus 187.
spilopus, Exocoetus 183.
spinachioides, Doryichthys 50.
spinicaudatus, Corythoichthys 76.
spinosissimus, Hippocampus 107, 108, 109.
spinosus, Anabas 334.
spinosus, Doryichthys 47, 92.
spiritalis, Ophicephalus 324, 325.
Spirobranchus 333.
Stenocaulus krefftii 123.
Stevensii, Ophicephalus 328.
stictorhynchus, Doryichthys 46.
Stigmatophora 36, 39, 97.
Stigmatophora argus 97.
Stigmatophora argus var. brevicaudatus 98.
Stigmatophora depressiuscula 98.
Stigmatophora gracilis 98.
Stigmatophora olivacea 97.
Stigmatophora unicolor 97.
Stigmatopora 97.
Stigmatopora argus 98.
Strabo 288.
strenua, Sphyraena 226.
striatus, Ophicephalus 317.
striatus, Ophiocephalus 314, 317.
striatus, Osphromenus 351.
striatus, Trichopus 351.
striga, Hemirhamphus 170.
strigata, Amphisile 20.
strigatus, Aeoliscus 19, 20.
strongylura, Belone 121.
Strongylura coromandelica 128.
Strongylura crocodila 129.
Strongylura leiura 124.
Strongylura leiuroides 125.
strongylurus, Mastacembelus 121.
strongylurus, Tylosurus 120, 121.
studeri, Ophiocephalus 328.
subosseus, Nannocampus 95.
subviridis, Mugil 233, 243.
sumatranus, Dermogenys 137, 139.
sumatranus, Hemirhamphus 139.
sumpit, Centriscus 16.
sundaicus, Syngnathus 75.
sundanensis, Mugil 235.
surakartensis, Philypnoides 321.
Synentognathi 115.
Syngnathidae 8, 30, 33, 34, 37, 92.
Syngnathina 35.
Syngnathoides 34, 39.
Syngnathoides biaculeatus 40, 41.
Syngnathoides blochii 40.
Syngnathus 36, 38, 77, 78.
Syngnathus acus 79, 88.
Syngnathus Andersonii 76.
Syngnathus argus 57, 97.
Syngnathus argyrostictus 79, 80, 82.
Syngnathus biaculeatus 40.
Syngnathus bicoarctatus 101.
Syngnathus biserialis 82.
Syngnathus boaja 47.
Syngnathus brachyrhynchus 88.
Syngnathus brachysoma 62.
Syngnathus brachyurus 44.
Syngnathus brevirostris 75.
Syngnathus budi 57.
Syngnathus carce 92.
Syngnathus compressus 59.
Syngnathus conspicillatus 70, 103.
Syngnathus corrugatus 73.

Syngnathus crenulatus 72.
Syngnathus cuncalus 44.
Syngnathus cyanospilos 83.
Syngnathus cyanospilus 79, 83.
Syngnathus dactyliophorus 42.
Syngnathus deokhatoides 53.
Syngnathus djarong 78, 79.
Syngnathus fasciatus 70.
Syngnathus fasciolatus 79, 83.
Syngnathus flavofasciatus 70.
Syngnathus fluviatilis 55, 56, 59.
Syngnathus gastrotaenia 80.
Syngnathus gracilis 80, 81.
Syngnathus Grayi 103.
Syngnathus haematopterus 70.
Syngnathus Helfrichii 79.
Syngnathus heptagonus 92.
Syngnathus heterosoma 48.
Syngnathus Hunnii 80.
Syngnathus intestinalis 70.
Syngnathus Jullieni 47.
Syngnathus koilomatodon 103.
Syngnathus Kuhlii 83.
Syngnathus leiaspis 57.
Syngnathus manadensis 46.
Syngnathus Martensii 54.
Syngnathus mataafae 77.
Syngnathus melanopleura 64.
Syngnathus mento 59.
Syngnathus micrognathus 59, 92.
Syngnathus micropterus 59.
Syngnathus Mossambicus 83.
Syngnathus parviceps 79.
Syngnathus pelagicus 79, 87.
Syngnathus penicillus 82.
Syngnathus polyacanthus 44.
Syngnathus punctatus 79, 86.
Syngnathus Retzii 52.
Syngnathus Schlegeli 44, 88.
Syngnathus serratus 99.
Syngnathus spicifer 78, 79, 80, 82.
Syngnathus spicifer var. djarong 79.
Syngnathus spicifer var. rivalis 79.
Syngnathus sundaicus 75.
Syngnathus tapeinosoma 80.
Syngnathus tetragonus 40.
Syngnathus tetrophthalmus 76.
Syngnathus trachypoma 103.
Syngnathus uncinatus 79, 84.
Syngnathus variegatus 90.
Syngnathus yoshi 58.
Syngnathus zambezensis 59.
Syngnathus zanzibarensis 101.
Syngnathus zonatus 47.
tade, Mugil 232, 236.
taeniata, Betta 355, 362.
taeniatus, Polynemus 202.
taeniophorus, Haliichthys 105, 106.
taeniophorus, Phyllopteryx 106.
taeniops, Hippocampus 110.
taeniopterus, Hippocampus 110.
tambakkan, Helostoma 340.
tanakae, Corythroichthys 76.
tapeinosoma, Syngnathus 80.
Telmatherina 267, 278, 279.
Telmatherina abendanoni 279, 281.
Telmatherina bonti 279, 280.
Telmatherina celebensis 279, 280.
temmincki, Atherina 268, 269, 271, 275.
temmincki, Helostoma 339, 340.
tenuis, Microphis 80.
teria, Polynemus 199.
testudineus, Amphiprion 334.
testudineus, Anabas 333, 334.
testudineus, Anthias 334.
testudineus, Sparus 334.
testudo, Lutjanus 334.
tetradactylum, Eleutheronema 197, 198, 199.
tetradactylus, Polydactylus 199.
tetradactylus, Polynemus 199.
tetragonus, Syngnathus 40.
tetrophthalmus, Syngnathus 76.
timorensis, Aplocheilus 372, 373.
timucoides, Belone 126, 127.
toxeuma, Sphyraena 223.
trachypoma, Corythroichthys 103.
trachypoma, Syngnathus 103.

Trachyrhamphus 36, 38, 98.
Trachyrhamphus caba 103.
Trachyrhamphus cultrirostris 99.
Trachyrhamphus serratus 99.
Trichidion heptadactylum 212.
Trichidion hilleri 214.
Trichidion indicum 205.
Trichidion kuru 209.
Trichidion microstoma 204.
Trichidion multifilis 217.
Trichidion plebejus 202.
Trichidion sectarium 210.
Trichidion sextarius 210.
Trichogaster 332, 341.
Trichogaster fasciatus 341.
Trichogaster lalius 341, 342.
Trichogaster trichopterus 366.
Trichogaster unicolor 342.
Trichopodus 333, 365, 366.
Trichopodus bejeus 341.
Trichopodus colisa 341.
Trichopodus cotra 341.
Trichopodus lalius 342.
Trichopodus leeri 366, 367.
Trichopodus trichopterus 365, 366, 367.
Trichopsis 350.
trichopterus, Labrus 366.
trichopterus, Osphromenus 366.
trichopterus, Trichogaster 366.
trichopterus, Trichopodus 365, 366, 367.
trichopterus, Trichopus 366.
trichopterus var. leerii, Osphromenus 367.
Trichopus 365.
Trichopus Leerii 367.
Trichopus sepat 366.
Trichopus siamensis 366.
Trichopus striatus 351.
Trichopus trichopterus 366.
tridactylum, Eleutheronema 198.
tridactylus, Polynemus 198.
tridentifer, Hemiramphus 150.
trifasciata, Betta 359, 360.
trilineata var. of Haplochilus javanicus 372.
trimaculatus, Hippocampus 108, 112.
troscheli, Liza 248.
troscheli, Mugil 233, 248.
Tylosurus 116, 117, 119, 120.
Tylosurus annulatus 120, 126.
Tylosurus caeruleofasciatus 131.
Tylosurus choram 129.
Tylosurus coromandelicus 128.
Tylosurus crocodilus 120, 128.
Tylosurus giganteus 126.
Tylosurus incisus 120, 125.
Tylosurus kreffti 120, 123, 134.
Tylosurus leiuroides 125.
Tylosurus leiurus 120, 124.
Tylosurus macrolepis 120, 122.
Tylosurus melanotus 119, 120, 127.
Tylosurus punctulatus 120, 129.
Tylosurus schismatorhynchus 131.
Tylosurus strongylurus 120, 121.
typhle, Siphonostoma 31.
uisila, Atherina 269.
uncinatus, Syngnathus 79, 84.
unicolor, Colisa 342.
unicolor, Exocoetus 189.
unicolor, Stigmatophora 97.
unicolor, Trichogaster 342.
unifasciatus, Hemirhamphus 149.
unifasciatus, Hyporhamphus 149.
unimaculata, Betta 353, 355.
unimaculatus, Parophiocephalus 355.
uronemus, Polynemus 205.
Urophori 34, 35.
urophthalmus, Ophicephalus 324.
Urvillii, Belone 122.
vagus, Ophiocephalus 317.
vaigiensis, Mugil 233, 244.
Vaillanti, Coelonotus 58.
vaisiganis, Zenarchopterus 169.
Valenciennei, Atherina 272.
valenciennesi, Atherina 268, 269, 272.

Valenciennesii, Mugil 235.
Valencienni, Choeroichthys 62.
valenciennii, Doryichthys 62.
valentini, Aulostoma 9, 10.
Valentini, Polypterichthys 10.
vanheurni, Rhombatractus 298, 299.
variegatus, Anabas 334.
variegatus, Syngnathus 90.
velitaris, Centriscus 16, 17.
velitaris, Macrorhamphosus 16, 17.
velitaris, Orthichthys 16.
venustus, Macropodus 347.
villosa, Fistularia 12, 13, 15.
viridi-auratus, Macropodus 346.
viridi-auratus, Macropus 347.
vittatus, Ctenops 350, 351.
vittatus, Osphromenus 351.
volans, Exocoetus 178.
volitans, Exocoetus 177, 182.
vulgaris, Colisa 341.
waigiensis, Liza 244.
waigiensis, Mugil 244.
waitei, Corythroichthys 71.
wakanourae, Yozia 101.
weberi, Dermogenys 137, 138.
weberi, Hemirhamphus 138.
weberi, Nannocampus 94, 95.
weberi, Rhombatractus 304.
wrahl, Ophiocephalus 317.
xanthopterus, Hemirhamphus 162.
Xenentodon 116, 132.
Xenentodon cancila 134.
Xenentodon canciloides 133.
Xenopoecilus, 377, 378, 380.
Xenopoecilus poptae 377, 378, 379.
Xenopoecilus sarasinorum 378.
yoshi, Siphostoma 58.
yoshi, Syngnathus 58.
Yozia 36, 38, 100.
Yozia bicoarctata 100, 101.
Yozia wakanourae 101.
zambezensis, Belonichthys 60.
zambezensis, Doryichthys 59.
zambezensis, Syngnathus 59.
Zantecla 288.
zanzibarensis, Syngnathus 101.
Zenarchopterus 136, 162, 164.
Zenarchopterus amblyurus 165.
Zenarchopterus brevirostris 164, 168.
Zenarchopterus buffoni 164, 170.
Zenarchopterus buffonis 170.
Zenarchopterus caudovittatus 164.
Zenarchopterus dispar 163, 164, 169.
Zenarchopterus dux 164, 169.
Zenarchopterus ectuntio 164, 165.
Zenarchopterus kampeni 164, 167.
Zenarchopterus novae-guineae 164, 167.
Zenarchopterus rasori 164, 166.
Zenarchopterus vaisiganis 169.
zonatus, Syngnathus 47.
zophomus, Polydactylus 204.
zophomus, Polynemus 204.